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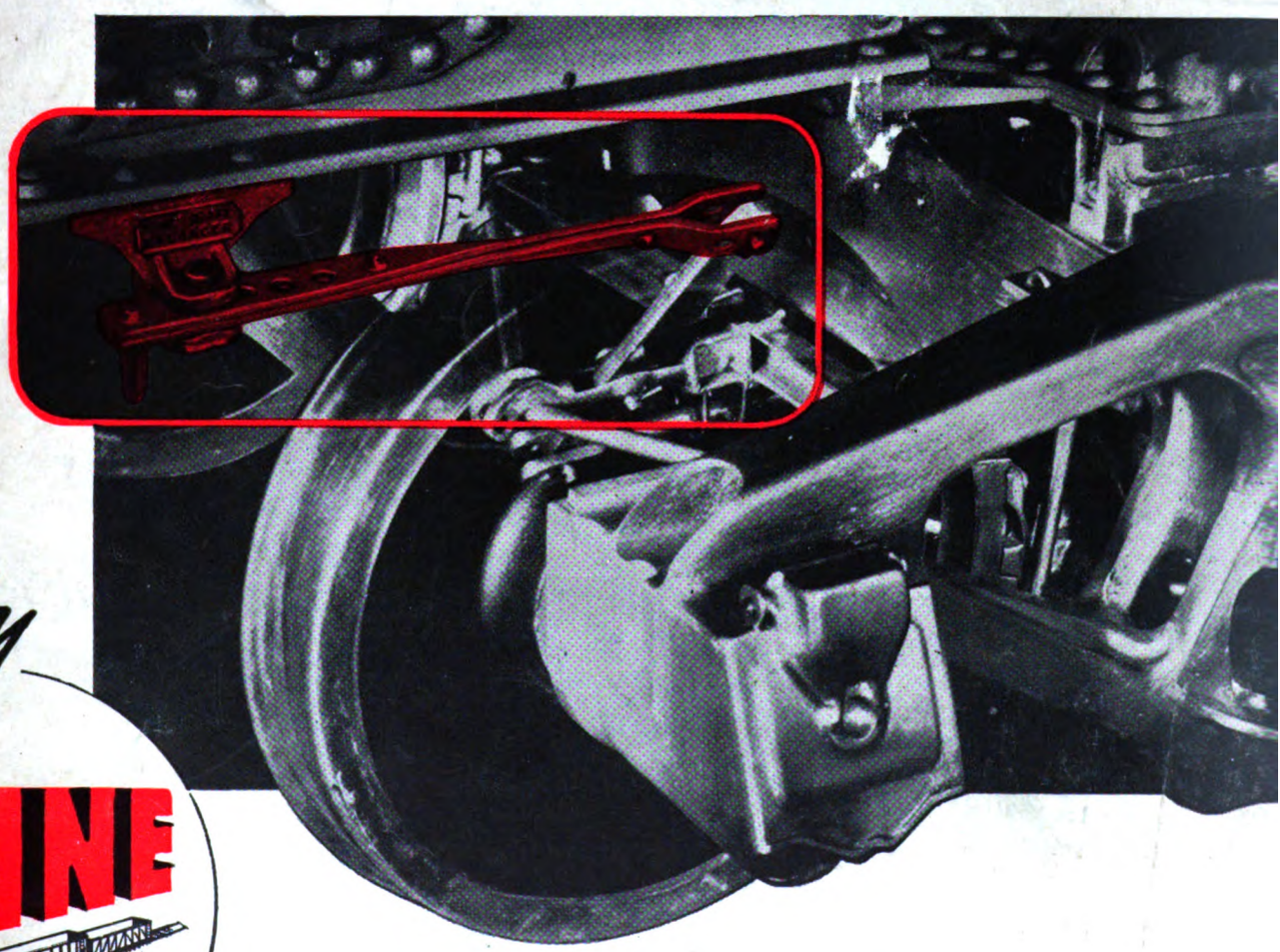
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VOLUME 125 No. 1

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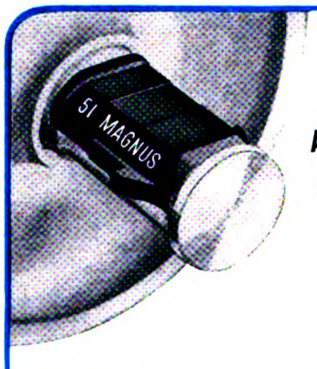
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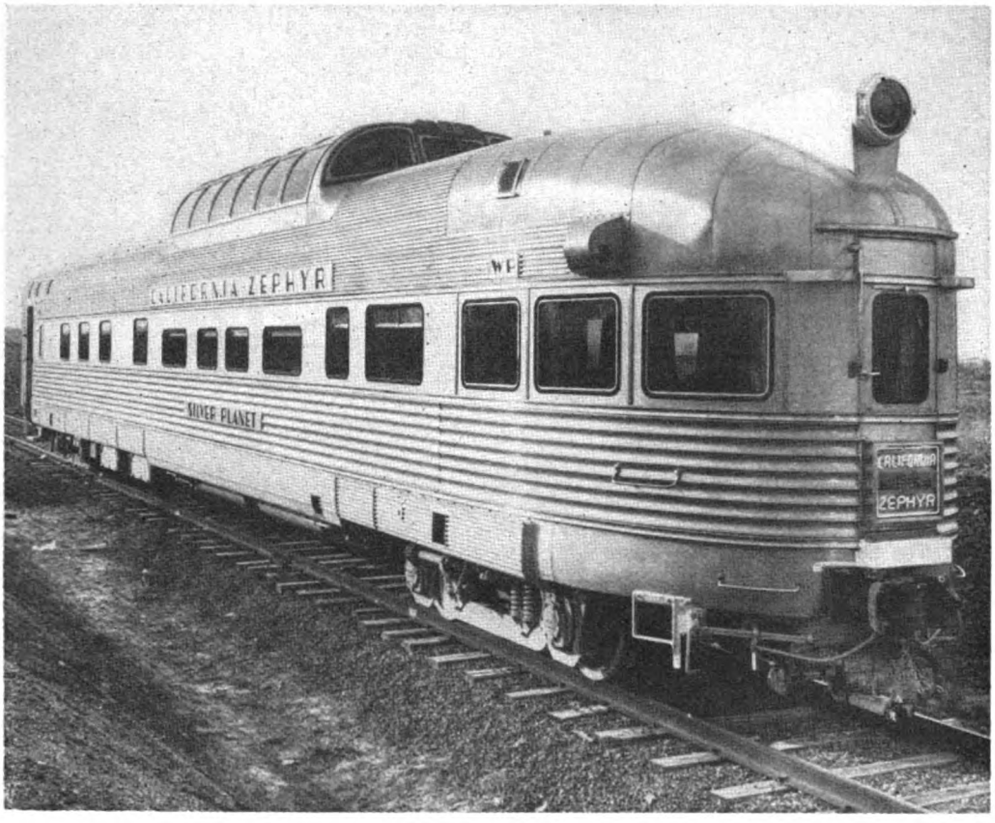
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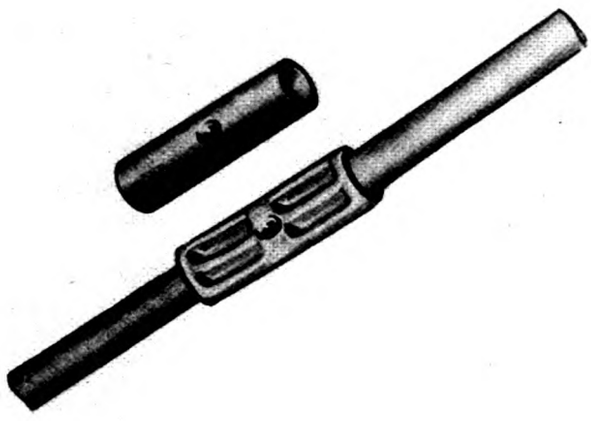


Sub-Assembly Methods Speed Car Wiring at Budd

Bench wiring, solderless terminals and special techniques assist in the installation of the more than three miles of wire used in an average car

BEHIND the comfort and convenience of each new passenger car with its increasingly complex electrical system, there lies a multitude of design and assembly problems. Control of power circuits, communication, lighting, heating, air conditioning, etc., have become so important that today *electrical failure* is usually synonymous with *car failure*, and as a result, wiring methods from blue print to finished car have become a specialized art. At Budd, for example, from 5,000 to 23,000 ft. of wire must be installed in each car, depending upon its type. Unlike early methods, where each car, like a house, was wired individually, the Budd Company tries to complete as much wiring as possible in subassembly, and it is this basic policy of pre- or bench wiring that is largely responsible for the speed, uniformity, and low cost achieved. The same basic techniques are used regardless of the number of cars on order.

Planning for the electrical program in Budd's Red Lion Plant (Philadelphia, Pa.) centers around the desired car performance, as modified by local and national electrical codes. Circuits must maintain their electrical and mechanical soundness under continuous vibration and the rugged operating conditions of all weather serv-

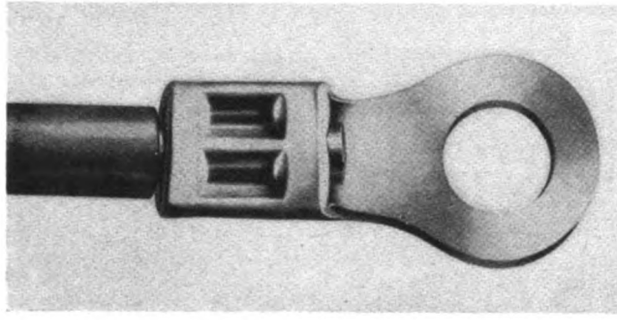


A butt connector before and after application

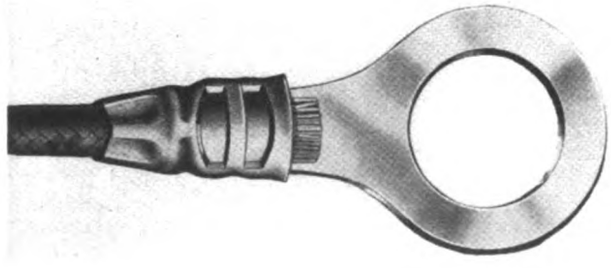
ice. Protection from the hazards of fire and accident are carefully considered. In addition, the actual assembly methods must be consistent with good plant economics and the wiring be as easy as possible to install.

The wiring is designed for a 20-year life span, the usual life expectancy of the car before major overhaul. This period can also be predicted by the natural aging of insulation and other such expected deterioration. For this reason little special provision is needed for maintenance, but if repair becomes necessary it will be seen that the same simplified methods of assembly lend themselves unusually well to replacement or inter-change of connection.

Since as much wiring as possible must be done on the bench, the problem of connection at some later time

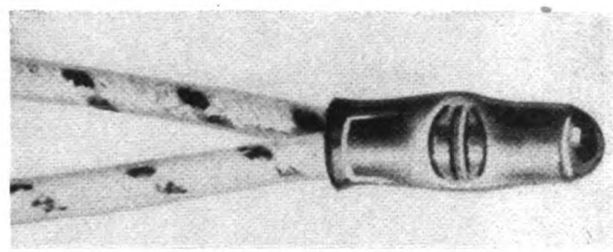


Two forms of terminals used for making connection to a terminal block or bolted lug-to-lug splice



is a vital one. A necessary adjunct to this construction method is therefore the wide use of pressure type solderless terminals, lugs, and connector blocks which facilitate quick assembly of the pre-wired sections. Whereever possible units are wired, harnesses built and laid in place, and the circuits quickly completed at convenient assembly stages by means of such connectors.

First procedure on each car order involves the preparation of electrical schematic drawings which are adjusted with buyer specifications, previous car prints,



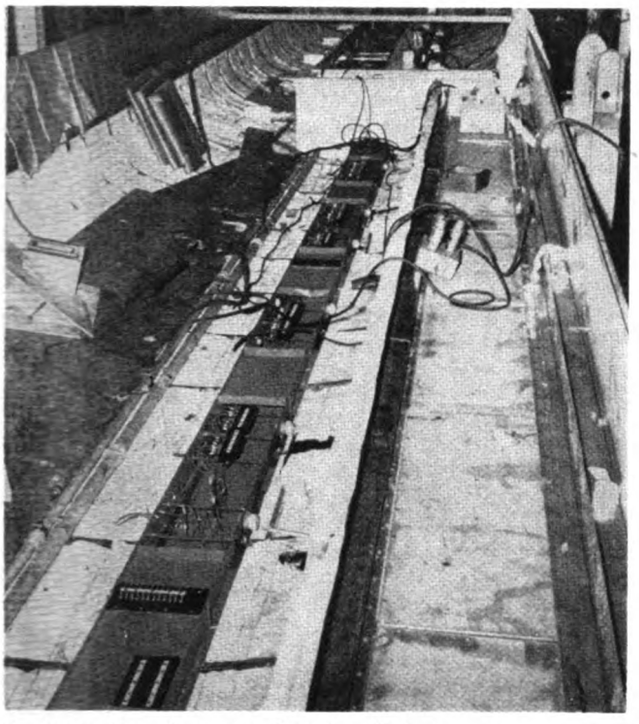
Pre-insulated pig tail splice

or new design trends to produce finished working drawings. Actual wiring is then broken for convenience into three major divisions: roof, or *overhead*; *underfloor*; and control or *regulator*. Each division, of course, is related to the other, but in general constitutes a separate, though similar, assembly problem.

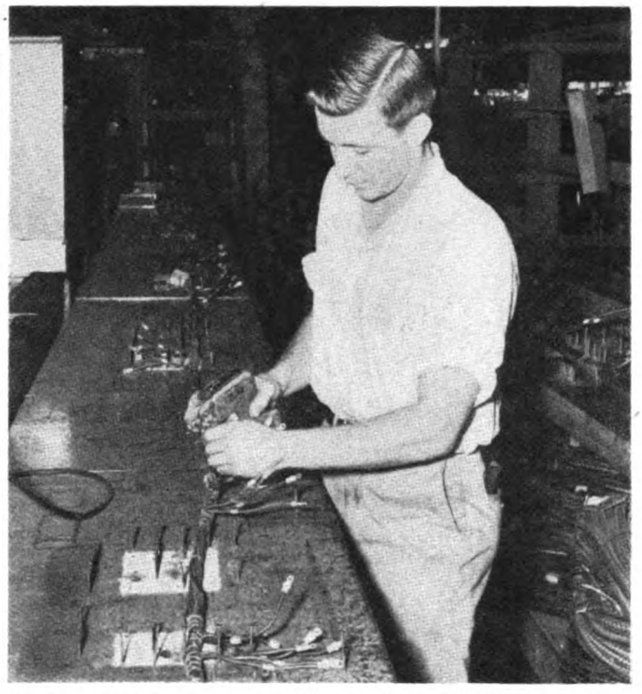
Since most heavy apparatus such as air compressors, generators, batteries, etc., are stationed beneath the car, a scale model is usually built of the underfloor division to assist in the proper routing of conduit and positioning of equipment. Such positioning is, of course, affected, in part, by the number and size of the wires to be enclosed in conduit, and in turn their length is determined by the final arrangement selected. Later a full scale mock up of the underfloor section is built to iron out actual physical assembly problems before the first or pilot car is put under construction. Power circuits fall in the underfloor division, whether from train line or self-contained generators or batteries, and feed their heavy gauge wires up to the electrical lockers or regulators which serve as a clearing house for the demand signals from the controls, switches, and thermostats scattered throughout the car. Power circuit wires go as high as 300,000 circular mils, and carry up to 800 amp. from the generator to distribution point. All wire is stranded for greater flexibility in short runs and sharp bends, and in these sizes the weight of the wire is the chief determinant of the method of termination. Lock type mechanical lugs are most often used since wires in this weight do not usually require support near the neck of the connector.

Branch circuits in the underfloor division are measured off according to blue print on long tables. Where possible they are tied, and terminated before being pulled through the conduit by Budd workers. Hand and pneumatic tools are used to attach the terminals securely in place. (See illustration).

The wiring of the regulator division is handled in similar fashion. Here it is possible to pre-wire all of the inter-connections in lockers and other controlling units. Even in these stages use can be made of harness boards which serve as a template for the locker harness.



An inverted roof exposes "overhead" duct with terminal blocks and harness in place



Budd worker uses a pneumatic tool to install Pre-insulated terminals on harness—The wires are measured off and tied on this full-size bench

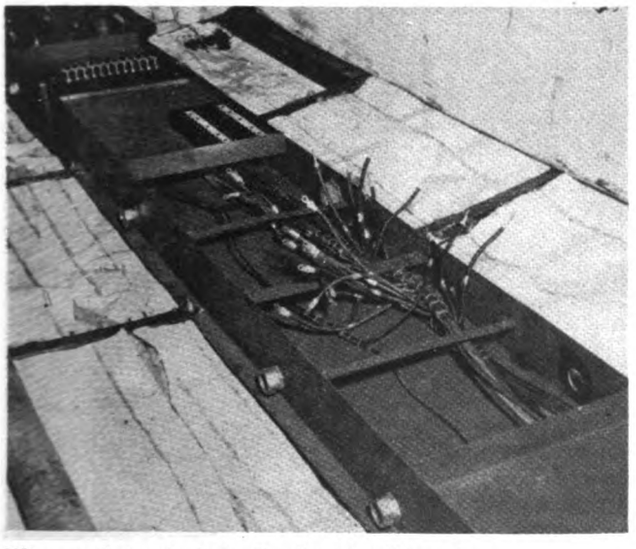
This procedure is imitated with smaller electrical apparatus or controls as they line up for installation at various station points.

Space is not a problem at Red Lion. The long assembly lines are equipped with overhead cranes which pick up roof, underframe, or the entire car in either upright or inverted position. This gives many advantages unknown to the smaller shop. As an inverted underframe arrives at station No. 004, for example, all of the heavy parts and equipment are exposed for easy insertion of steam piping and electrical conduit.

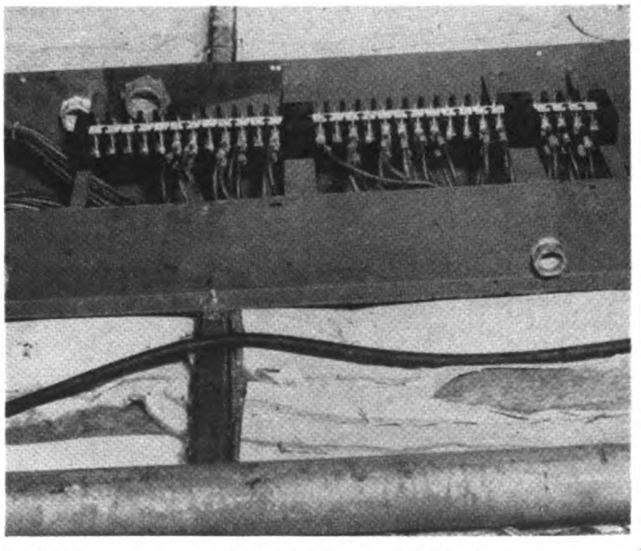
Conduit is employed wherever possible to protect the wires, serve as a guard, and prevent fires caused by a short circuit or overload of current. Underneath the car, where there is maximum exposure to weather, corrosion, etc., thick-walled conduit is used with standard threaded fittings. Wires entering suspended or movable equipment are protected by more flexible covering.

When the number of wires warrants, as in a sleeping car, duct is substituted for the thin-walled conduit usually employed in the overhead section. Threadless box connections make smooth, tight joints with safe-edge fittings to meet U.L. Underwriters specifications.

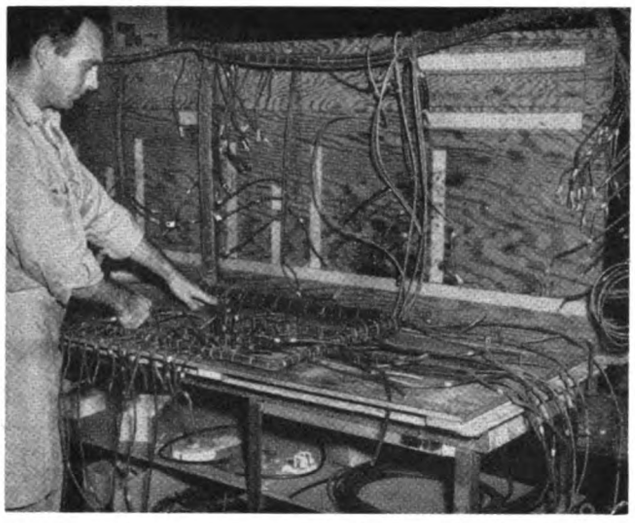
Wiring begins in the overhead section while the roof is still in an inverted position and easily accessible. Long harnesses are made and laid into position with little



Wires and terminals in the "overhead" section



A close-up of terminal blocks in the overhead section



Prewiring of control panels begins on this bench—Wires are tied, identified and terminated at this point

difficulty. Illustrations shows a Budd employee terminating leads with a pneumatic hand tool for later connection to a terminal block or similar distribution point.

The connection of the three systems is facilitated by terminal blocks which receive the pre-terminated wires to be joined in successive assembly stages. Two types of connectors are used. In the wire range from No. 8 to No. 6, where vibration is dangerous at the junction of wire and terminal barrel, the connectors used are Pre-insulated, manufactured by Aircraft-Marine Products Inc. This terminal has an outer sleeve which clamps over the wire's insulation and prevents fraying or sharp bending. In addition, the terminal is integrally insulated, so that no separate tape or tubing is required. On larger ranges, from No. 8 to No. 6, a non-insulated connector is used which features exceptionally high strength crimp. These joints are then taped.

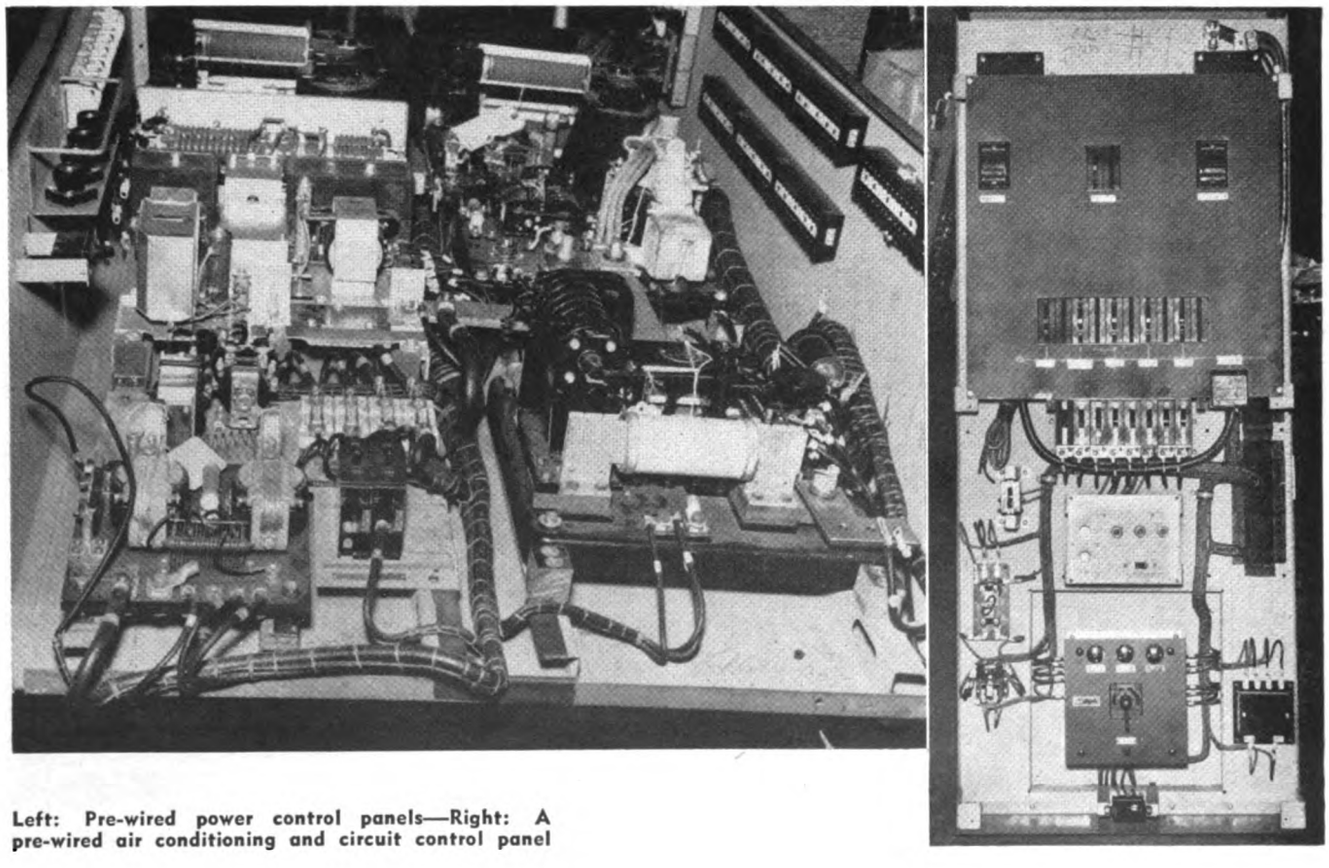
Three main types of connections are used. First by terminal block, described above, whose leads are bolted down to a common distribution point. In this case, each lead must be terminated before the harnesses or bundles of wire are laid in place. From 800 to 2,000 such solderless terminals are used in a single car.

Unterminated wires can be spliced directly with Pre-insulated closed-end connector which forms a quick, secure pig tail splice. Butt connectors can also be used to advantage in many situations requiring a direct line splice. In these cases, the only preparation needed is to strip the wire, as the connectors are already insulated and require no solder, tape or special attention.

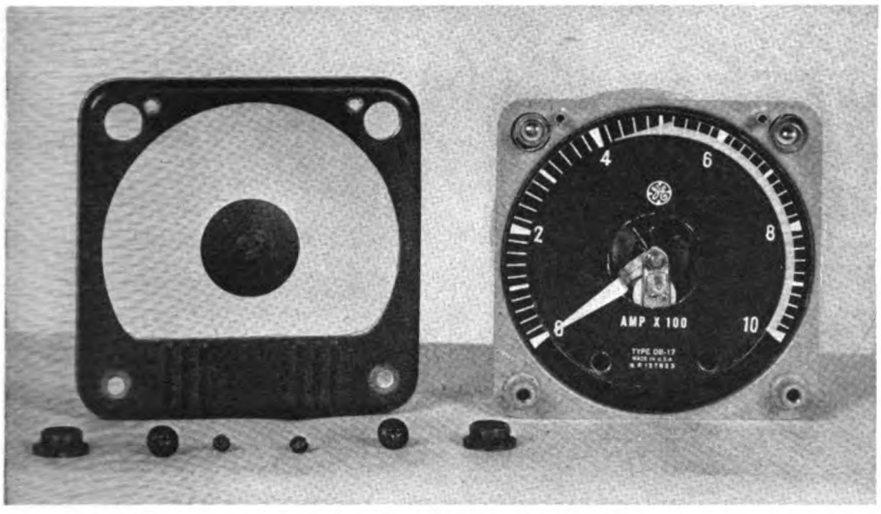
Terminated wires are often bolted together to form a lug-to-lug splice. These connections can be easily unbolted if necessary, but offer little advantage over the direct splices which can be clipped and re-joined if necessary.

All wiring is subjected to careful tests before cars are released. In addition special climate test chambers simulate extreme operating conditions—although most of these problems have been anticipated from actual field experience.

Mass production techniques, assisted in large measure by these wiring methods, continue to be the largest single factor responsible for Budd's 36 years of efficient operation. And in the process, Budd has created a new name in car building.



Left: Pre-wired power control panels—Right: A pre-wired air conditioning and circuit control panel



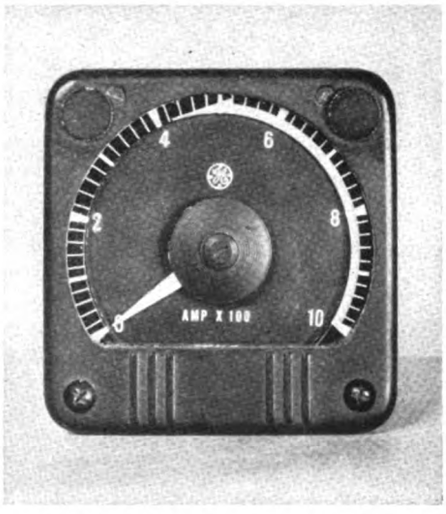


Fig. 1 (left)—Locomotive-type ammeter with cover removed to show location of lamps for illumination of dial—Fig. 2 (right) External appearance of completely assembled locomotive-type ammeter

Locomotive Instrument Lighting

Individually lighted instruments and gauges of uniform design for Diesel-electric locomotives made available by three manufacturers

By F. H. Catlin *

INSTRUMENTS play an important part in the operation of modern, electric-drive locomotives. To meet the requirements of this service, they must be accurate, rugged and easy to read under all conditions. At the same time they should meet appearance design standards and be suitable for grouping in any desired panel arrangement.

For several years, the General Electric Company has furnished a rectangular form of instrument for locomotive service which is easy to read in daylight, and can be worked satisfactorily into a system using black light illumination for night operation. An alternative type of instrument, not requiring black light, has also been developed and is now available.

With the exception of black light, the various instrument illuminating systems that have been used depended upon a central light source around which the instruments were grouped. In some designs, light was conveyed to the instrument faces by troughs extending over the edges of the front covers. In others, the instrument cases were slotted to admit light to the scale and pointers.

There are obvious disadvantages in all such systems. It is difficult to obtain satisfactory light distribution and, at times, there may be objectionable glare. The instruments are definitely confined to the location of the light source so that panel arrangements cannot be varied to meet appearance design requirements. To overcome these disadvantages, the General Electric Company has developed an illuminating system that is an integral part of each instrument case. Small lamps are mounted in the two upper corners of the instrument case in such locations that the light falls on the scale and pointer. The instrument mechanism is shielded from most of the heat

* Locomotive & Car Equipment Divisions Laboratory, General Electric Company, Erie, Pa.

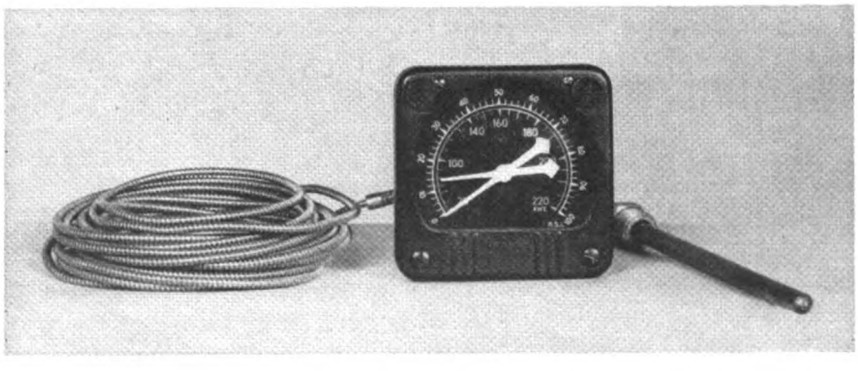
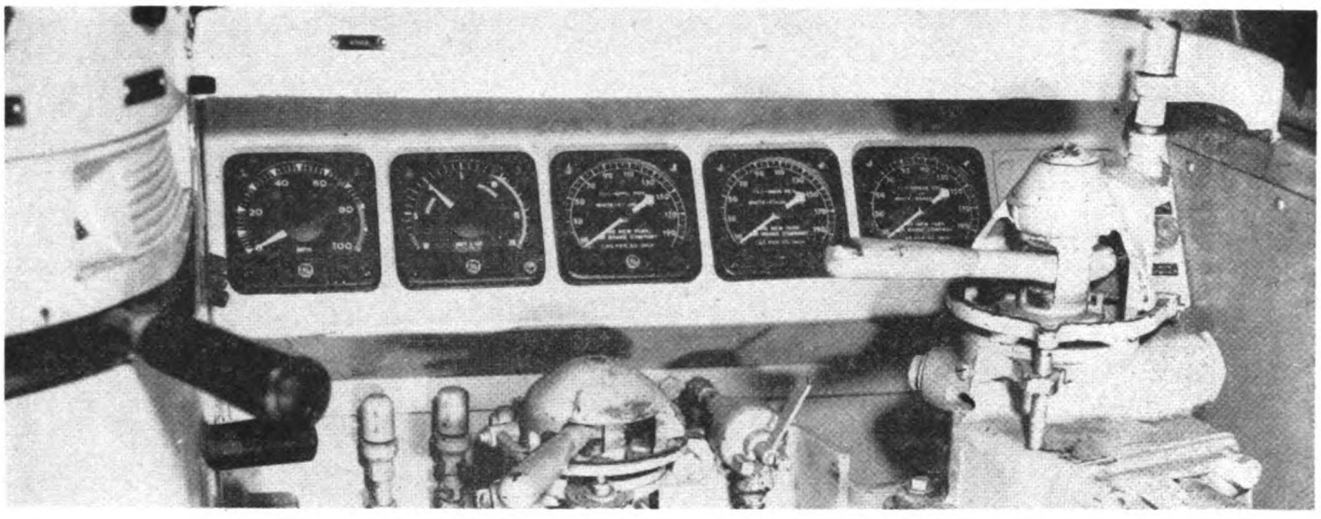


Fig. 3—Duplex pressure gauge mounted in same style case



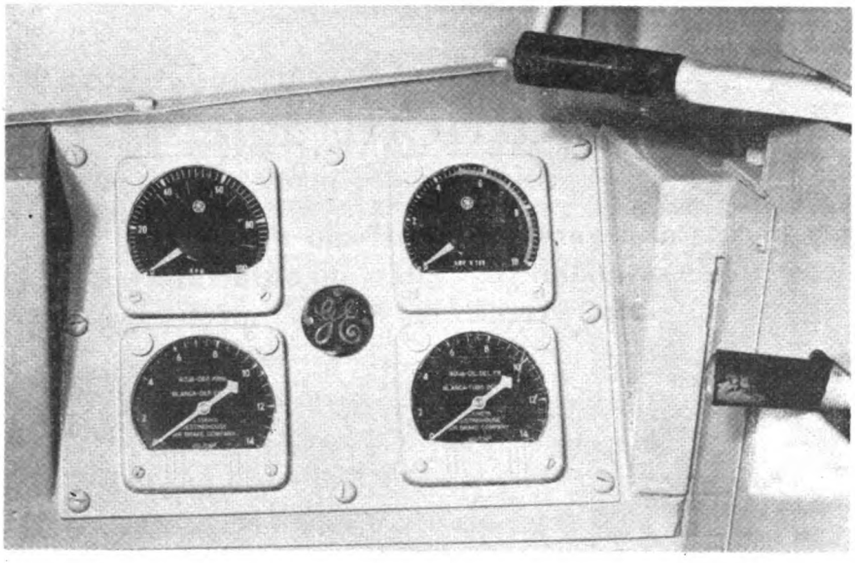


Fig. 4—(above and left) Typical engineman's instrument panels on two locomotives for mainline service, illustrating clear visibility of instruments and their flexibility of arrangement

produced by the lamps because the lamp sockets and mountings are external to the part of the case containing the instrument element.

Figure 1 shows the location of the lamps in one of the new type ammeters. The front cover and window are held in place by four screws fitting into weld nuts, two located in the lower corners and two at the top of the instrument adjacent to the lamp housings.

Figure 2 shows the instrument completely assembled with the front cover in place. Access to the lamp bulbs is obtained by removing the screw caps in the upper corners of the cover. An extractor is furnished for removing and replacing the lamp bulbs without disturbing the instrument cover. This illuminating system is available in various types of G. E. locomotive instruments, such as ammeters, speedometers, and voltmeters.

Gauges indicating pressure and temperature are also frequently used on locomotives. To insure adequate illumination and pleasing uniformity of panel appearance, there is available a line of single and duplex pressure gauges, and also duplex temperature and pressure instruments with an illumination system and front cover assembly identical to that used for the electric instruments. These are manufactured by the United States Gage Company. One of these instruments is shown in Fig. 3. In addition to the instruments shown, the Ashton Valve Company manufactures duplex vacuum gauges in the same style of case and cover assembly.

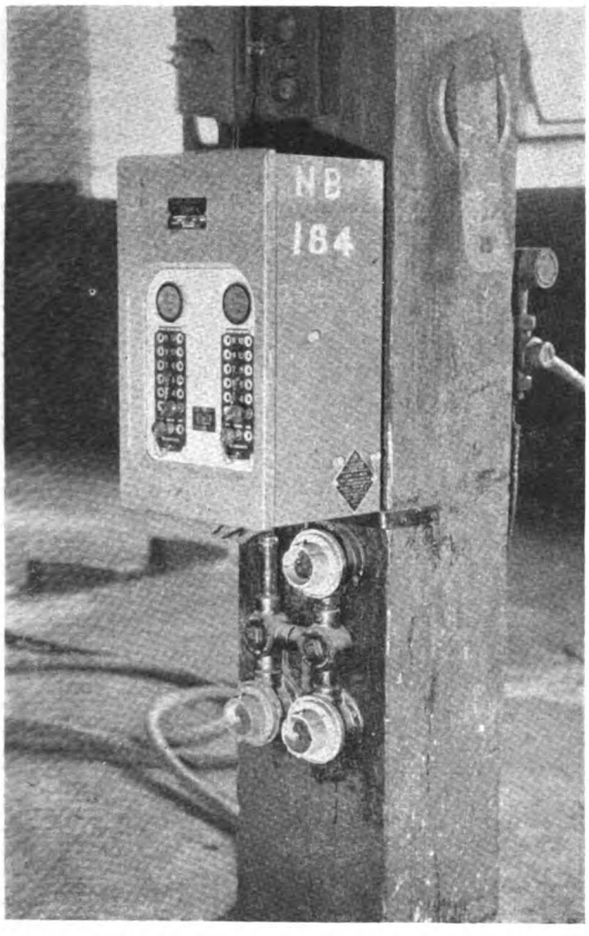
This complete line of transportation instruments offers several advantages for locomotive installations. All instruments on a control panel have a uniform appearance. All instruments are adequately lighted, regardless of their location. Light intensity can be controlled on individual instruments or on all instruments simultaneously by means of rheostats within easy reach of the engineman. All lamp wiring is accessible, and the two lamps in each instrument case can be connected in series or parallel to suit circuit conditions. Loss of illumination on one instrument has no effect on the others in the panel. The instruments do not have to be grouped around a central light source. This means that they can be used in any desired panel arrangement.

While this line of instruments was developed primarily for transportation service, the same illuminating system can be adapted to other specialized applications of G.E. 4½-in. square switchboard instruments. Other items, such as gauges, temperature and pressure indicating instruments, etc., may be obtained from gauge manufacturing companies that are equipped to produce this style of instrument.

Circuit Arrangement Facilitates Use of Charger

By W. E. Abbott

THE battery charger shown is used for charging Diesel-electric locomotive and electric-crane truck batteries. At the North Bergen, N. J., enginehouse



Choice of receptacles below charger determines the rate of charge

of the New York Central, it is mounted on a column adjacent to the stall used for Diesel inspections and repairs.

The charger has two rates of charge, 6 and 12 amp. Each half of the charger will charge from one to twelve, 3-cell batteries at the rate of 6 amp. by moving a plug to the proper hole for the batteries being charged.

If the rate of charge desired is 12 amp., the two sides can be so connected that while the rate of each half is 6 amp., the total will be 12 amp.

The picture shows three receptacles mounted below the charger, they are BRA-23-T Pyle-National receptacles such as are used for cable connections between the engine and tender of steam locomotives. These receptacles are for three wires. The rubber covered cord, with three No. 14 wires, that is used on steam locomotives is used for the charging leads. A BP-35 P.N. plug is applied at one end and a battery clip at the other end, with the three wires attached to the clip.

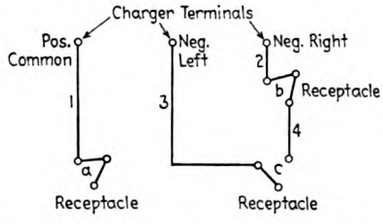
A copper disc is used in the plug end to tie the three legs together. The disc fits between the two parts of plug interior and is cut away at the screw holes where the plug assembly screws pass through the two halves so that the disc does not make contact with any part of the plug shell.

Three leads are brought out of the bottom of the charger, one positive lead common to both sides of the charge, and two negative leads, one from each side of the charger.

The positive lead *1* is brought to the receptacle *a* at the bottom left, and connected to all three of the terminals.

The negative Wire *2* from the right side of the charger is brought to the top right receptacle *b*, and connected to all three of the terminals.

The negative Wire *3*, from the left side of the charger, is brought to the bottom right receptacle and connected to two of the three terminals. Wire *4*



Wiring diagram for charger secondary circuits

connects the third terminal of *c* to the three terminals of *b*.

The plug and clip used on the positive lead are painted red, and the second lead is painted gray.

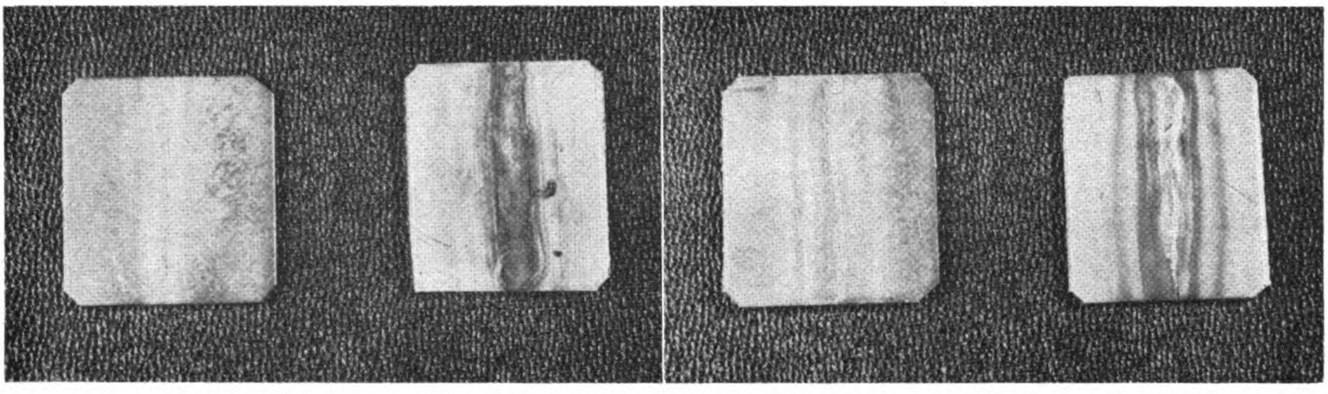
By plugging the red lead in *a*, and the gray lead in *b*, the current will be 6 amp. from the right side of the charger. Changing the gray lead to *c* will give 12 amp.

The circuit for 6-amp. charging is as follows. The common positive lead from the charger through wire *1* is connected to the three terminals of *a* and the three plug contacts tied together by the copper disk causes the current to pass through the three No. 14 wires of the cord out to the clip where they are all fastened to the clip, and attached to the positive side of the battery.

From the negative side of the battery, the circuit is carried through the clip of the negative lead, through the three wires of the lead to the plug to terminals of *b*, and through Wire *2*, to the negative side of the right side of charger.

The circuit for 12-amp. charging is as follows: the common positive side of the circuit is the same as for 6-amp. charging. The negative circuit is carried from the negative side of the battery, through the battery clip and the three wires of the lead, through the plug to the terminals of *c* and Wire *3* to the left side of the charger and through Wire *4* to the three terminals of *b* and Wire *2* to the right side of the charger.

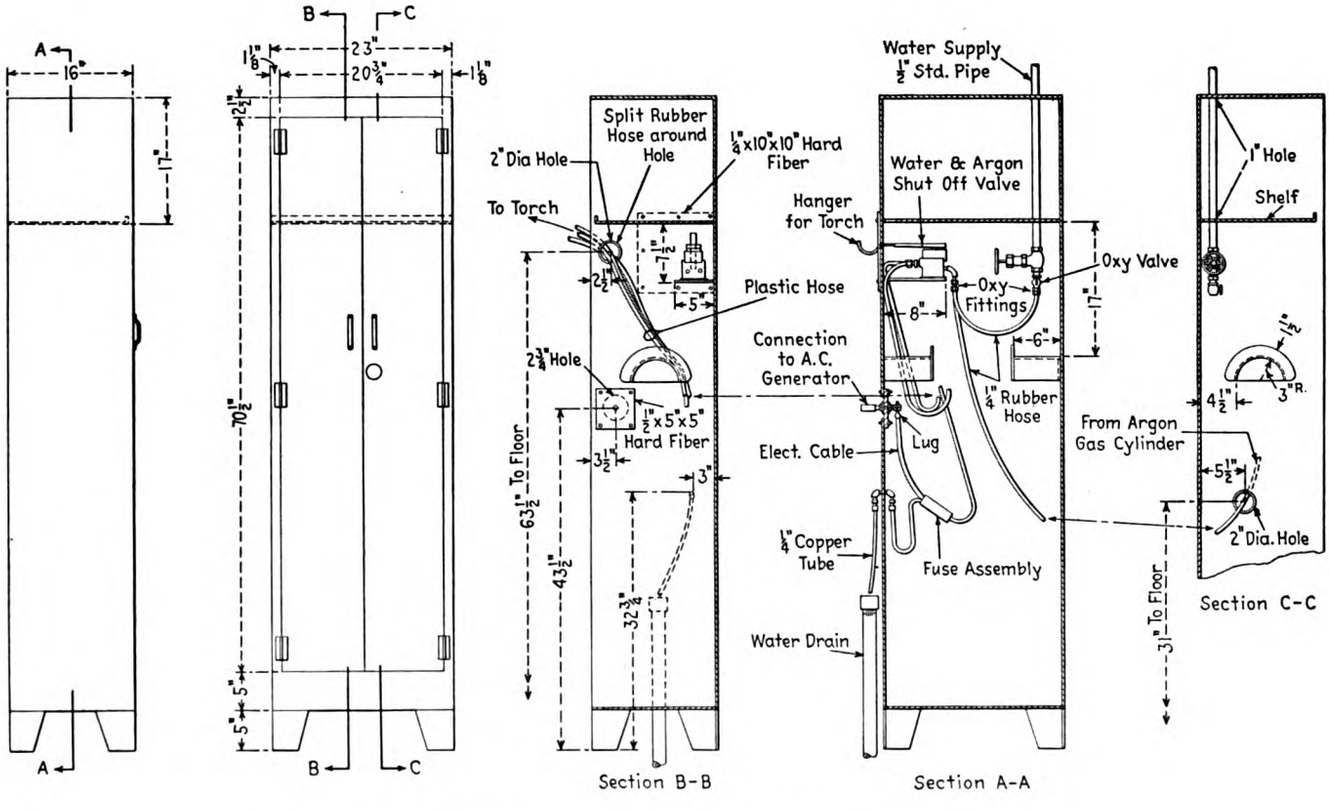
Side Sheets Without Visible Seams



Left: Samples of inert arc welding made respectively on silicone copper (left) and stainless steel (right)—Right: Reverse side of sample welds

Southern Pacific finds inert-arc welding advantageous for the welding of sheet metal in many railroad applications

THE general shop of the Southern Pacific at Los Angeles, Calif., has been equipped for inert arc welding, and experience has shown the process to be well suited to a number of railroad practices. The process is primarily a means for joining sections of sheet metal including stainless steel, aluminum and silicone copper.



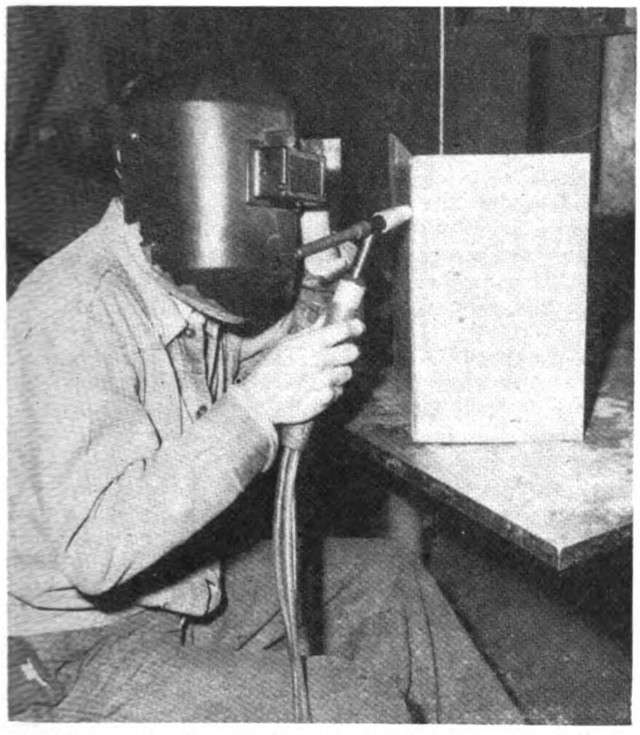
Side and front elevations of the Southern Pacific inert-arc welding service cabinet

On the Southern Pacific it is used for the welding of sheets from .02 in. to ⅛ in. in thickness. Applications include car siding, stainless steel for diner kitchens, water supply tanks for cars, fuel and water tanks for Diesel locomotives and a variety of other purposes. In most cases, the sheets to be joined are placed edge to edge and are welded without filler metal. A filler rod is used in the case of two dissimilar metals, a 10-10 Everdur rod, for example, being used to weld steel to silicone copper.

In the case of very thin metal, the edges are flanged before welding to provide filler metal. Sixteen gauge metal is welded by hand at a rate of about six inches per minute.

Shop Equipment Facilitates Performance of the Work

Car side sheets may be welded with no perceptible warping of the sheets and little fitting up is required.



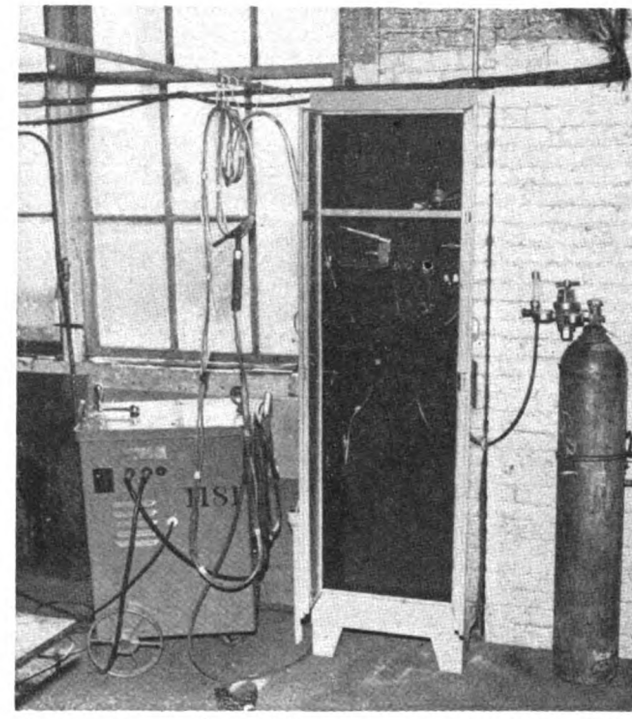
Welding a stainless steel section for a dining car kitchen

Polished-out butt welds are not visible as is the case when filler rod is used.

The welding is accomplished by means of an arc maintained between a tungsten electrode and the metal to be welded. The electrode is water-cooled and an inert gas (argon or neon) flows out around the electrode covering the arc. This protects the arc and the weld from the air and prevents the inclusion of oxygen, nitrogen and other impurities into the weld.

In the Southern Pacific installation, power for silicone copper and aluminum welding is supplied by an a.c. welding machine rated at 10 to 200 amp. It is equipped with high-frequency arc control for aluminum welding. Direct current is used for the welding of ferrous metals other than stainless steel.

A steel cabinet for storing equipment and for making all the necessary electrical gas and water connections was developed by the railroad. A water connection is brought in at the top, argon gas at one side, and an electrical connection at the opposite side provides a connection to the Flex Arc welder. Oxy-acetylene fittings are used for making water and gas connections.



Flex-arc, a.c. welder and the shop-made cabinet for storing equipment and making all necessary gas, water and electrical connections

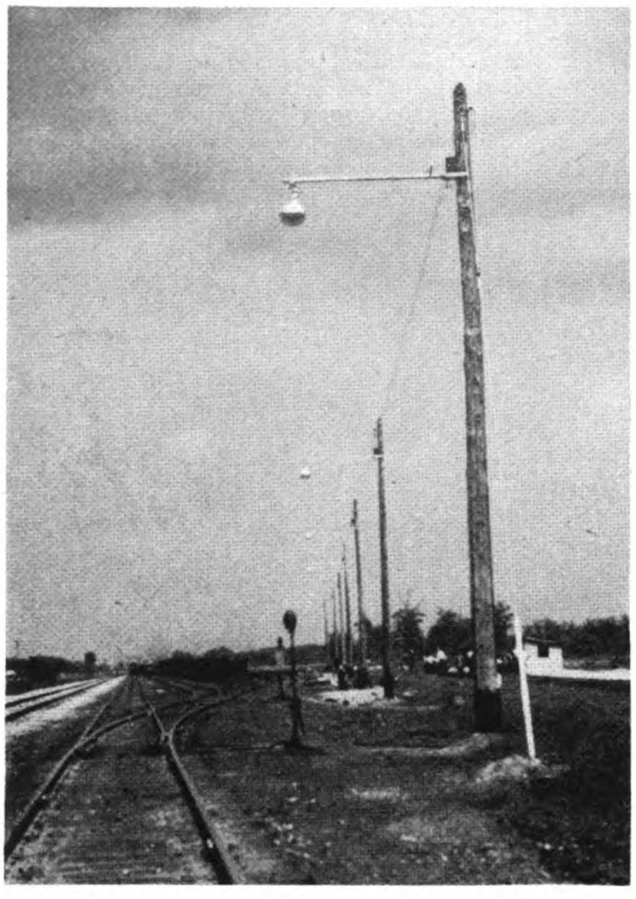
A hook at one side of the cabinet is used to hang up the welding torch when it is not in use. This hook is on the end of an arm which operates two valves. The valves cut off the supply of gas and water when the torch is not in use.

Mercury-Vapor Lighting of Interchange Yard

The Elgin, Joliet and Eastern has recently made an installation of mercury-vapor lighting in its Griffith-Hartsdale, Indiana yard. The installation is proving to be very practical and economical.

The layouts of the track are such that ordinary floodlighting did not seem practicable. Further study indicated conventional street lighting units, mounted on high poles, would produce the needed illumination.

In the yard shown in the illustration, the E. J. & E. handles heavy interchange traffic with four other railroads. At times the yard is occupied by several trains, and a switch engine, picking up or setting out and switching cars. The lights serve effectively to increase safety and speed of operation and to reduce or prevent pilferage and damage to cars or lading.



The lights provide adequate illumination for the interchange work done in the yard and produce no objectionable glare

The lighting units are General Electric Form 109 luminaires, equipped with 16,000-lumen, Type F-H1 mercury vapor lamps. The units have top-tapped mounting and produce I. E. S. Type IV distribution.

The units are mounted on Hubbard No. 3610 chain-operated trolley-type mast arms. The length of the mast arm is 10 ft., and the mounting height of the unit is 30 ft. The horizontal spacing of the luminaires is 125 ft. (average).

Commercial power at 2,300 volts to the primary of railroad transformers is supplied from local public utility circuits. The lights are turned on and off by a Sangamo astronomic time switch.

Insert Control Facilitates Engine Testing

The Southern Pacific Taylor Diesel shops at Los Angeles have improved and simplified the load testing of Diesel engines on locomotives by an adaption of a piece of war surplus material shown in the illustrations—purchase price 25 cents.

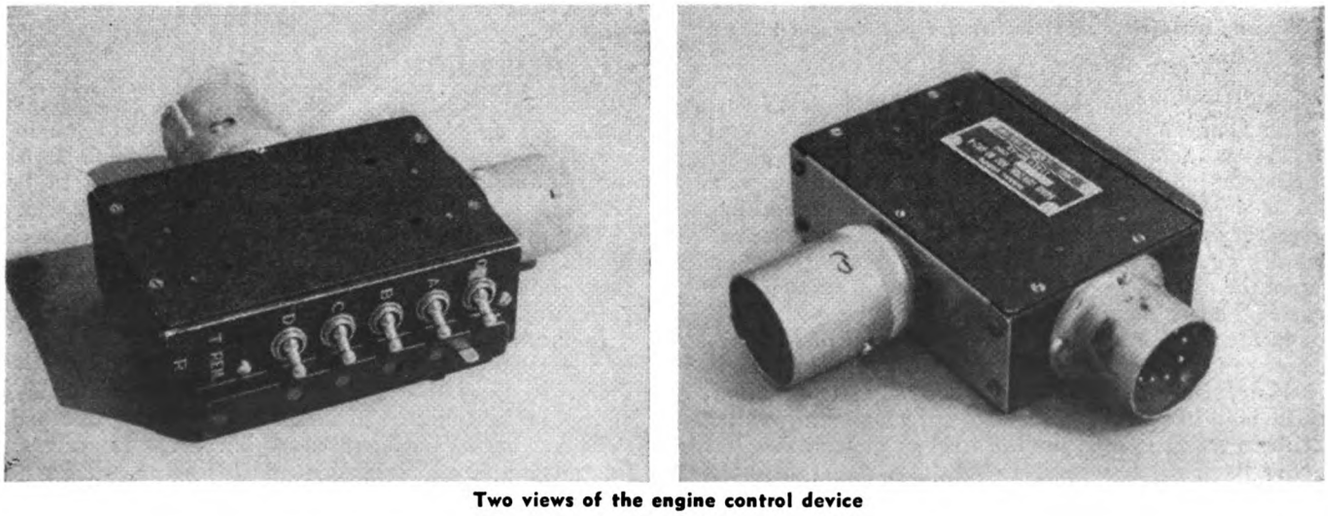
Load testing engines is accomplished by running the engine on various throttle settings and loading the generator on a resistance load. This is usually accomplished by three men—one operating the throttle, one making tachometer readings at the front end of the engine, and one operating the loading resistor or water rheostat. Communication between the man operating the throttle and those at the tachometer and rheostat is necessary and is also difficult.

The device illustrated permits control of the engine by the man who makes the tachometer readings. To use the device, the control cable is disconnected from its receptacle at the fuel rack relays and the device inserted in the circuit.

The receptacle on the long side of the device serves simply to connect with the 64-volt power supply. The other receptacle corresponds to the control receptacle which was disconnected.

By operating the toggle switches in different combinations, it is possible to duplicate all of the connections made at the throttle and operate the engine at any desired speed.

Testing is thus simplified and errors due to faulty communication are eliminated. Circuit connections inside the device were changed from their original form to meet the requirements of Diesel engine control.



Two views of the engine control device



Fruit Growers Express car equipped with Thermo King refrigerating and heating system

A Mechanical Refrigeration System for Cars

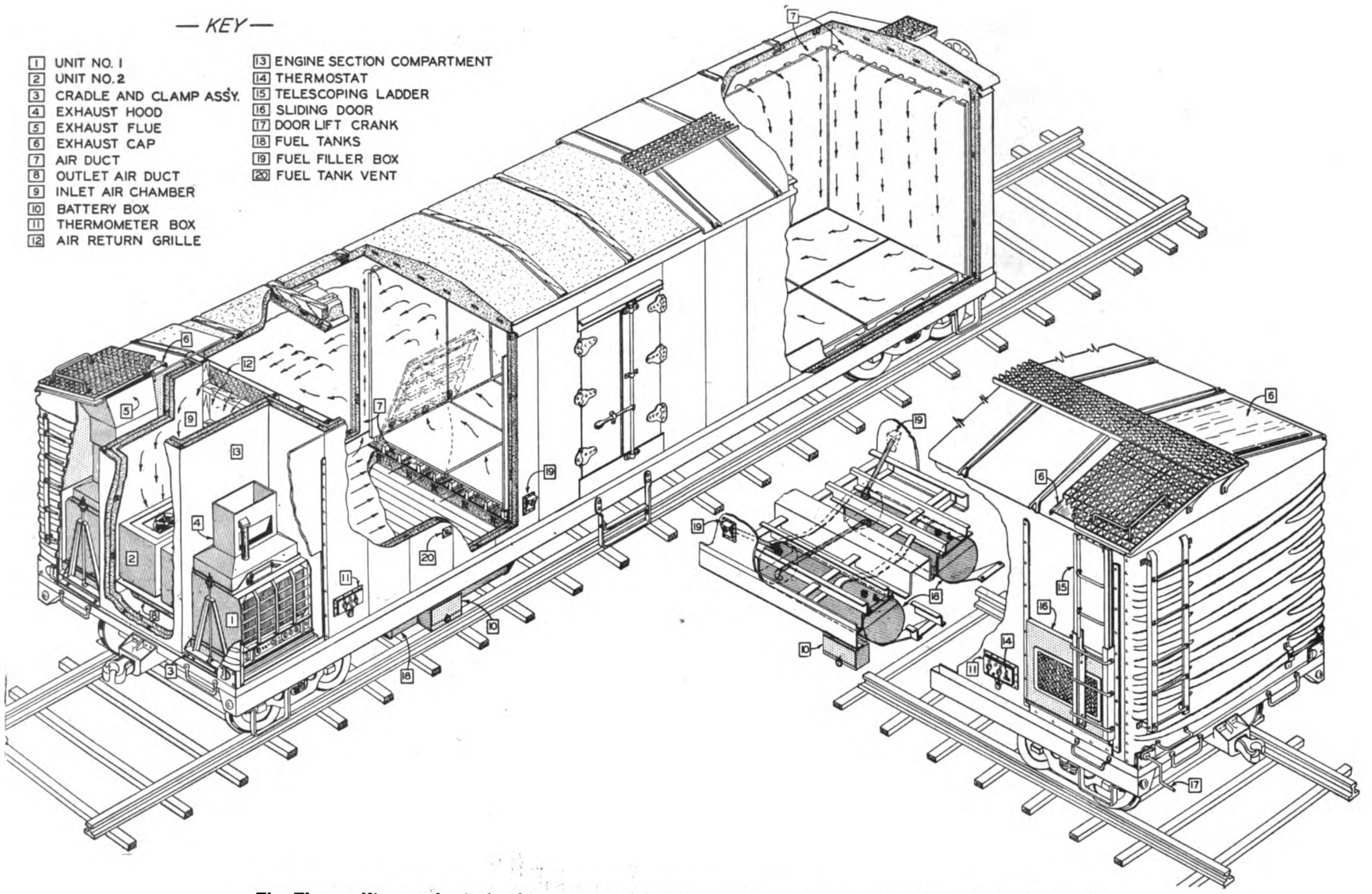
THREE refrigerator cars in which mechanical refrigerating and heating equipment is installed have been undergoing service tests in the United States and Canada for the past two years. These are Canadian National car No. 209661, Western Fruit Express car No. 67564, and Fruit Growers Express car No. 39897. They are equipped with Thermo King refrigerating and heating units which operate to maintain automatically any temperature for which the thermostat is set, irrespective of whether the demand is for cooling or heating.

Several other cars have been similarly equipped. The Fruit Growers Express also has on order 1,100 cars to be built with 6 in. of insulation in which provision will be made for the later installation of mechanical refrigerating equipment. Thermo King units are in service in 14,000 highway trucks.

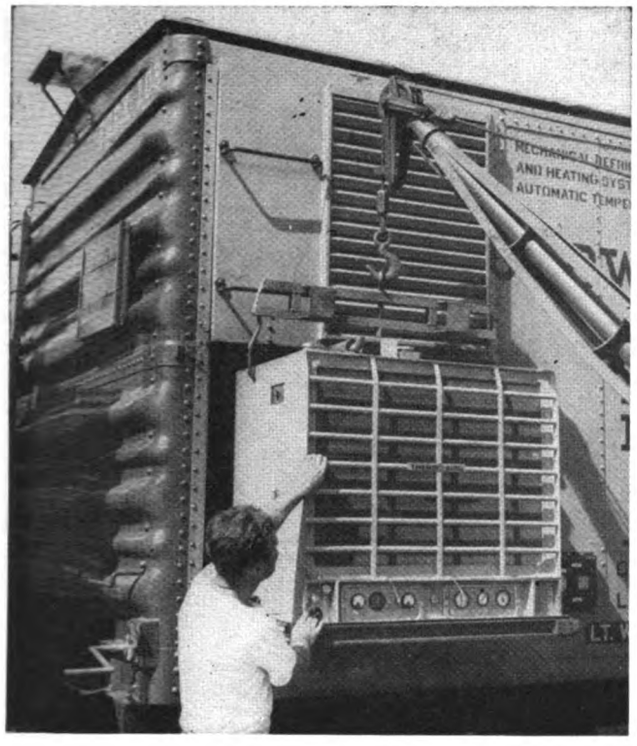
The refrigerating equipment occupies the space of the ice bunker at the end of the car. To insure unbroken service during a trip there are two complete units. Each unit consists of a 28-hp. gasoline engine, a direct-connected Freon compressor, a condenser and a generator mounted in a single housing, and an evaporator unit and motor-driven air-circulating fan. The engine and compressor units are placed one on either side of the end of the car and can be removed for replacement through a grill door in the side of the car. The unit is mounted on a rolling platform which is readily pulled out of the car for replacement of the unit and pushed back into the car with the new unit in place. Two connections—one for fuel and one for controls—are made before the unit is pushed into the car. The sliding door is closed by a crank applied in a socket in the end of the car. Closing the door also lowers a hood which carries the exhaust and hot air from the condenser up and out through a capped hatch in the roof of the car.

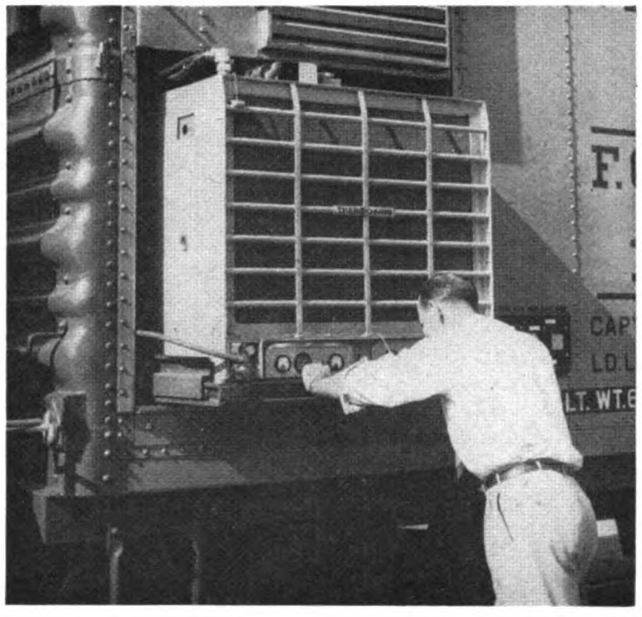
In an insulated compartment between the two engine-compressor units are the two evaporators and the fans by which the air is circulated around the load. The air is forced out through ducts under the solid floor which direct it into the space between the load and the end and side walls of the car through which it flows upward, thence over the top of the load and back to the air chamber above the evaporator units through a grill in the top of the bulkhead. The load is thus surrounded by air at the temperature at which the load is to be maintained. When required, heat is provided by operating on the reverse-cycle or "heat pump" principle.

The temperature to which the load is cooled and at which it is held is determined by thermostat setting. Once the thermostat is set, the control of the unit is automatic The controls include starting and stopping the set to meet the demands of the load for cooling or heating, changing the operation of the set from cooling to heating or vice versa, when the outside temperature drops below or rises above that for which the thermostat is set, and starting a battery-powered electric recirculating fan to prevent the development of uneven temperatures while the unit is off. During precooling periods both units are in operation. After the temperature of the interior of the car has been reduced to the thermostat setting, one unit shuts down and a single unit protects the load thereafter. The other unit then operates as a stand-by. It automatically takes up the load should the operating unit fail. Each unit is equipped with an automatic time-regulated defrosting device which goes ino operation every five hours.



The Thermo King mechanical refrigerating and heating system occupies a space of one ice bunker in the car, with fuel tanks and storage battery mounted underneath—The lading space is of the cold-wall type





Left: Placing an engine-compressor-condenser unit on the rolling platform—Above: With fuel and control connections in place, the unit is rolled into the car

The two units have a capacity of three tons of refrigeration at zero degrees F. One unit has sufficient capacity to maintain the temperature in the car at zero.

Two fuel tanks are located under the car. These are connected and can be filled from either side of the car. They have a combined capacity of 155 gal. Fuel consumption depends on the weather conditions and the duration of the trip from loading to unloading of the car. In general, consumption is heaviest during the summer months when the cooling load is greatest and lightest during the spring and fall when the load varies between light heating and light cooling.

A box on each side of the A end of the car contains thermometers and a system of signal lights which tell at a glance the operating condition of both units. These include indications of the temperature at the top and bottom of the load and the thermostat setting.

A development of interest to shippers was revealed at a press conference in New York on December 7 by Frederick McK. Jones, chief engineer of the U. S. Thermo Control Company, Minneapolis, Minn., manufacturers of the Thermo King equipment. This is in the field of humidity control that is expected shortly to enable shippers of such products as lettuce and strawberries to avail themselves of the advantages of mechanical refrigeration. It will eliminate top and body icing, and prevent slime, mold, wilting and dehydration.

This involves a system of dampers that seal off the cargo compartment and stop the fresh produce from "breathing." These dampers do not swing into sealing position until moisture brought out by the preliminary cooling process has been carried away. But once the product has attained the desired coolness, the "lid" goes on and the refrigerated air for the remainder of the haul is confined to the cold walls that envelop the load. To prevent stratification, a small auxiliary fan circulates air within the cargo space.

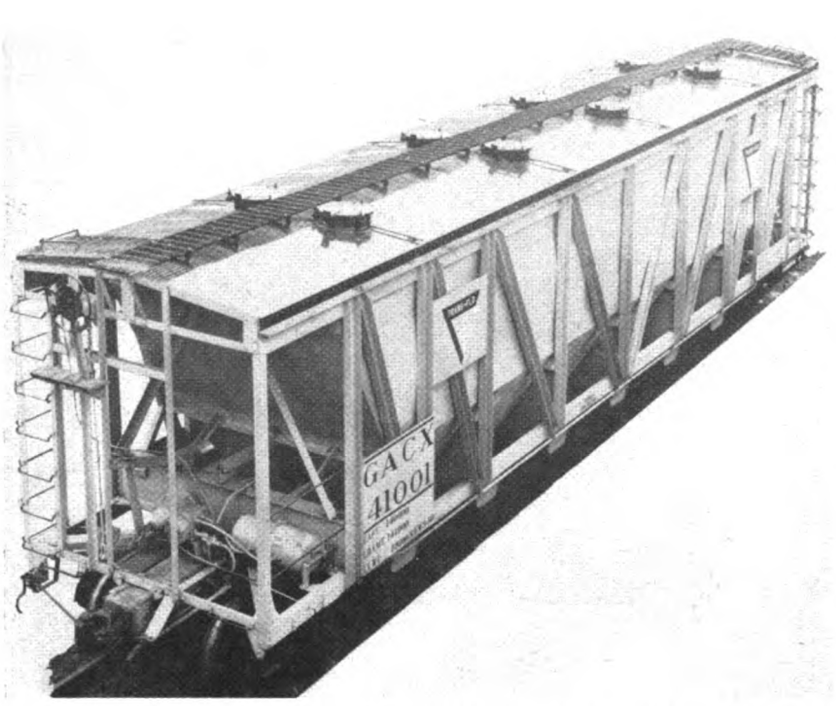
The humidity control device will eventually become a regular part of Thermo-King units for both railroad cars and trucks.

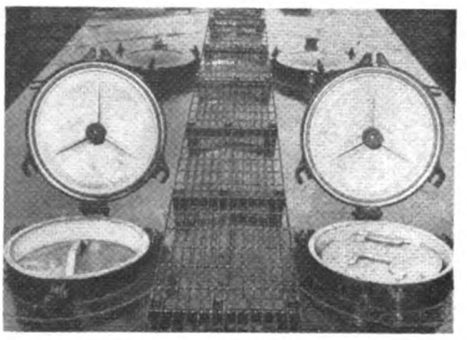
The service testing of the Thermo King equipment in refrigerator cars began late in 1948. The cars have handled apples, canned goods and frozen fish on transcontinental trips in Canada; and frozen meats, frozen concentrates, apples, oranges, and potatoes through all seasons in the United States on routes varying from less than 900 miles to over 3,000 miles. The temperatures of the loads at unloading have been uniformly close to the thermostat setting, and the condition of the lading excellent.

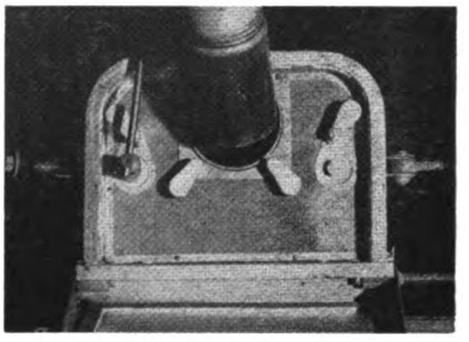
In one Canadian trip the mechanically refrigerated car carried 30,000 lb. of frozen halibut between Prince Rupert, B. C., and Montreal, Que., a distance of 3,000 miles during which outside temperatures ranged from 38 to 104 deg. F. This trip was made between June 23 and July 2, 1949, with an elapsed time of 206 hrs., during which 220 Imp. gal. of gasoline were consumed, including pre-cooling as well as demands during the trip. According to the Fisheries Research Board the temperature distribution in the car was better than is found in many cold storage rooms in which frozen fish is stored.

In a trip of 3,000 miles between Ontario, Cal., and New York, between October 12 and October 23, 1949, a load of oranges was delivered, the temperature of which ranged from 41 to 45 deg. F. When loaded, the temperature of the fruit averaged 73 deg. and the atmospheric temperature 95 deg. With the thermostat set at 45 deg. the product temperature was reduced to an average of 45 deg. in 12 hrs. 45 min. after the car doors were closed. The fuel consumption was 85 gal.

Experience with these cars indicates that maintenance, depreciation, interest, and the operating cost of the refrigerating equipment will average about 27 cents per hour of elapsed time in service. Units will be repaired at centralized points. Removing them from and replacing them in the car does not require skilled labor.







Right, top: Two loading hatches open while unloading, with filter and dummy filter in place. Bottom: Unloading nozzle on flexible stainless-steel hose is being connected to one of the hoppers.

General American Trans-Flo Car for Bulk Transportation

A covered hopper for flour, plastics and dry chemicals loads by gravity and unloads pneumatically with protection from infestation and contamination

THE TRANS-FLO covered hopper car, recently developed by the General American Transportation Corporation, Chicago, is especially designed for the sanitary and efficient bulk transportation of dry, granular or powdered commodities, such as flour, plastics, chemicals and pharmaceuticals. It is not intended for the shipment of materials normally handled without fear of contamination or infestation in conventional covered hoppers which can be unloaded by gravity, but, utilizing a pneumatic unloading system, it gives full protection to lading and extends the advantages of bulk handling to numerous commodities formerly requiring transportation in individual bags or packages.

About 25 of the new Trans-Flo cars are now in flour service and have demonstrated not only important savings in material and labor costs, but such advantages as greatly improved sanitation, freedom from infestation, higher capacity loads, reduced loading and unloading time, and elimination of damage claims. The car, slightly more than 55 ft. long over coupler pulling faces, has a nominal capacity of 140,000 lb.; light weight of 68,100 lb.; load limit of 141,900 lb.; cubic capacity of 3,150 cu. ft. in two welded stainless-steel compartments, supported in the car superstructure; 70-ton trucks; and Duryea double-cushion underframe.

The new car is the result of over two years of extensive research and testing by General American in close collaboration with the National Biscuit Company and the Fuller Company of Catasauqua, Pa. The investigation was conducted in a special laboratory built by General American at its plant in East Chicago, Ind. This laboratory is equipped with a full-scale section of a Trans-Flo car along with a Fuller Airveyor System, which is used to unload the commodity from the car. Thus, it is possible

to conduct demonstrations in the laboratory closely approximating actual conditions at the unloading site.

General Features

While the Trans-Flo is essentially a covered hopper car, it differs from the standard-type car in that it is composed of two large compartments (1,575 cu. ft. each), each having six sets of hopper-type bottoms. It has to be unloaded pneumatically and cannot be unloaded by gravity. A syntron electro-mechanical vibrator, applied to each hopper as it is being unloaded, assures a uniform flow of lading and overcomes any tendency for it to stick to hopper slope sheets. The entire unloading operation can be performed by one man in less than four hours.

Each compartment now has two loading hatches, although some have been built with four. Improvements in loading procedure have made the extra hatches unnecessary.

Trans-Flo cars are furnished on the basis of a 10-year lease. Because they are privately owned, railroads pay a mileage allowance for each mile that the car travels, either empty or loaded. This mileage allowance, in turn, is credited to the lessee's account, thereby reducing the cost of the car to the customer.

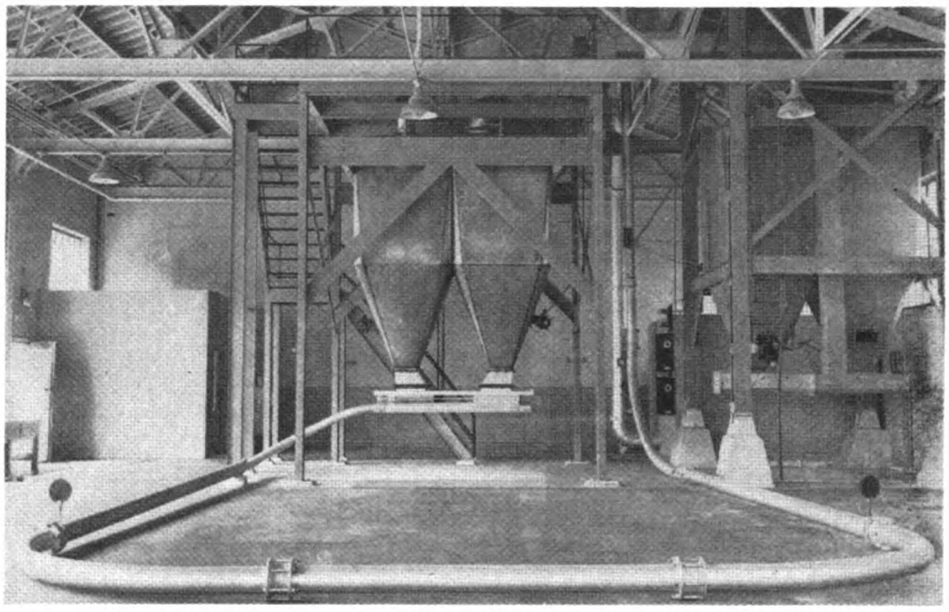
There are no mechanical moving parts in the car, thus eliminating the possibility of mechanical failure which would prohibit prompt unloading at point of destination. The cars may be loaded at the mill by gravity, by merely diverting the millstream into the car. An air-powered spinner has been developed which permits the car to be loaded within inches of the roof. This helps prevent condensation by keeping the air space between the top of the lading and the roof of the bin to a minimum. Condensation is said to be insignificant, summer or winter.

No Infestation or Contamination

Experience indicates that, in the bulk handling of flour by pneumatic equipment, the development of weevils and other internal infestation appears to be almost completely arrested.

Contamination of the lading also is virtually impossible. For example, the roof hatches as well as the unloading nozzle assemblies have filters which prevent any outside contaminating substance from coming in contact with the lading during either loading or unloading operations. The interior welding is ground smooth to minimize the possibility of lading clinging to the welds, and the corners of the hopper bottoms are rounded.

When the car is being filled, the filter is attached to the hatch cover in such a way it cannot become contaminated. When the car is being emptied from the bottom, the hatches are opened and the filters prevent dust or contamination from coming into the car with the outside air.

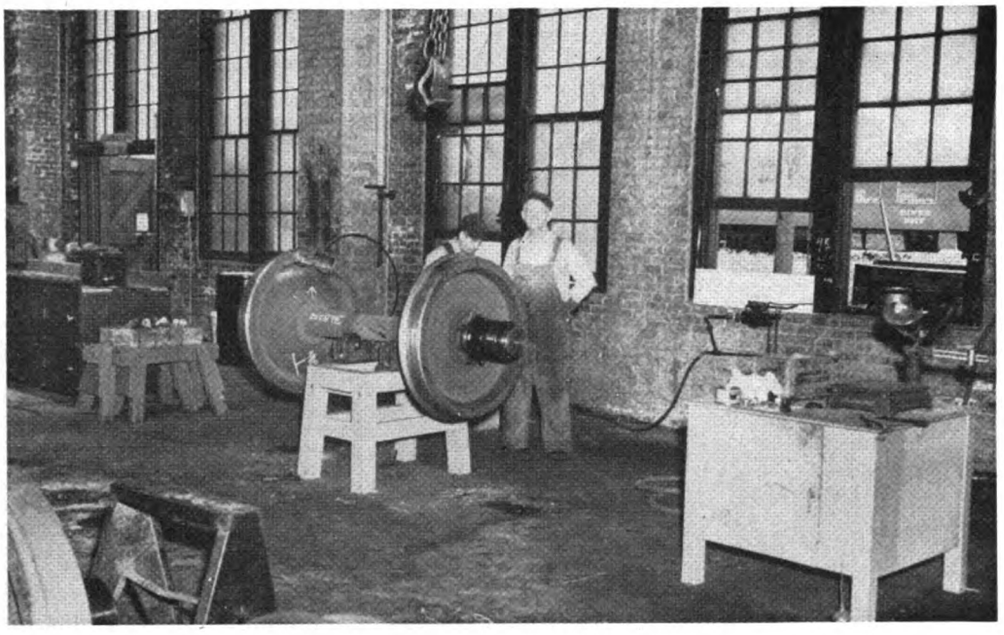


General American laboratory installed at the East Chicago plant to solve problems such as the bulk handling of dry, granular or powdered materials in a railroad car

The hatches are also equipped with a channel to drain out water. As a consequence, the car can be safely emptied even during rain. In transit, the hatch covers carry a wire seal placed by the railroad, and there is no way of raising the hatch cover without breaking the seal.

At the point of consignment, the bulk car is spotted at the railroad siding and the Fuller pneumatic conveying system is connected via a flexible hose line to the nozzles on the bottom of the car. The valve gates are opened and the lading flows from the compartment into the nozzle, whence it is drawn through the pneumatic system to the storage bin, which may be either on the inside or outside of the bakery. Two cars may be unloaded by one man, using the pneumatic system, in an eight-hour shift. Bakeries which lack large bulk storage space within the plant may erect inexpensive storage facilities on the outside, which may be insulated and protected by the plant heating system and thus operate satisfactorily in all climates, through all changes of weather.

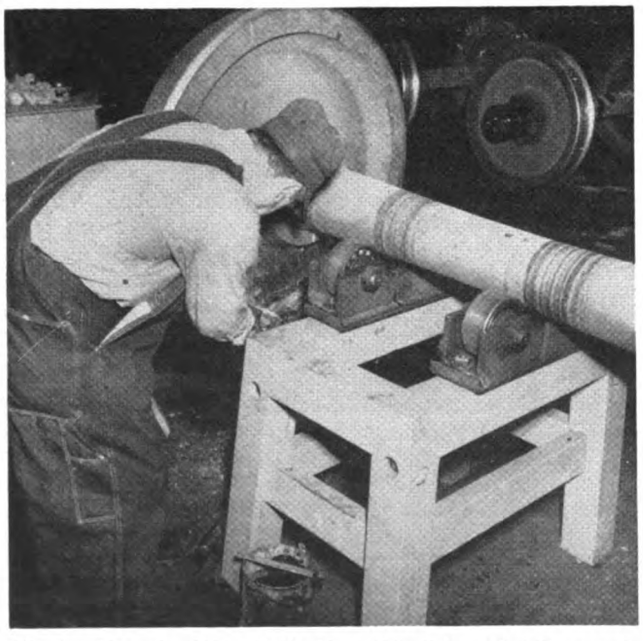
The pneumatic system of moving flour within the plant consists of seamless steel tubing with long-radius bends and machined companion flanges to form perfect joints. Stainless steel is used where necessary in the pneumatic filter and other mechanical parts to give smooth surfaces and prevent coating. All parts of the system may be opened for complete sanitary inspection. Since the new method is a conveying system it may be combined with mechanical equipment for completing the killing of insects and the destruction of eggs, and with equipment for removing foreign material from the flour stream.



Roller-equipped wheel stand (left) — Small steel bench for babbit weighing and melting (right)

Car Wheels Dynamically Balanced at Burnside Shops

THE Illinois Central has recently installed equipment for the dynamic balancing of car wheels on a production basis at its Burnside (Chicago) shops. The production-line set-up, was developed by J. F. Monger, general shop superintendent and J. J. MacLeay, general car shop foreman at Burnside, in cooperation with the Bear Manufacturing Company.



Tinning the wheel for application of babbit metal to correct the unbalance

Experience with the dynamic balancing of car wheels at Burnside shops indicates that the average unbalance is between 2½ to 3 lb. per wheel, with a maximum of 5 lb. By means of the I. C. production line methods, wheels are completely balanced statically, as well as dynamically in an average of 20 min. per pair of wheels. About 6 to 8 min. are taken for the actual balancing operation, while the rest of the time is required to make corrections is done by applying the specified amount of babbitt metal permanently under the inside rim of each wheel at the indicated spot by tinning and soldering.

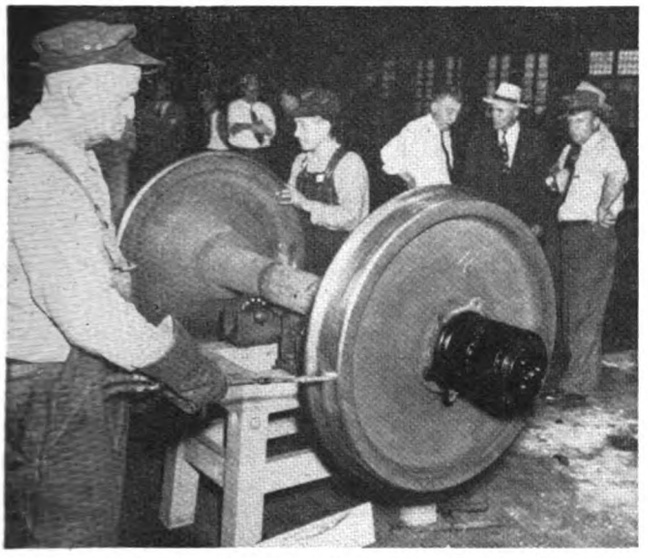
Dynamic Balancing Not New

The I. C.'s original interest in dynamic balancing first took place several years ago, with the installation of a Bear dynamic balancing machine at the Burnside Diesel shop. Dynamic balancing soon became a regular part of the maintenance routine. In the course of balancing such large rotating parts as main generator and traction armatures, maintenance records pointed out the time, labor and money-saving effects of dynamic balancing. As soon as the point was reached where armatures, other generator parts and air conditioning equipment were dynamically balanced regularly as a matter of routine, maintenance costs were reduced. A reduction in bearing wear was noticed, with consequent elimination of frequent "tear-down" jobs to replace worn bearings. The

life and efficiency of commutators and brushes were also increased, due to the elimination of vibration by dynamic balancing of the armatures.

Experimental Wheel Balancing

In the light of these results with armature-balancing, I. C. maintenance officers decided to do some experimental balancing of car wheels whenever there was a lull in armature-balancing activity. Changing over the set-up



The wheel rim is preheated lightly and uniformly throughout the entire circumference

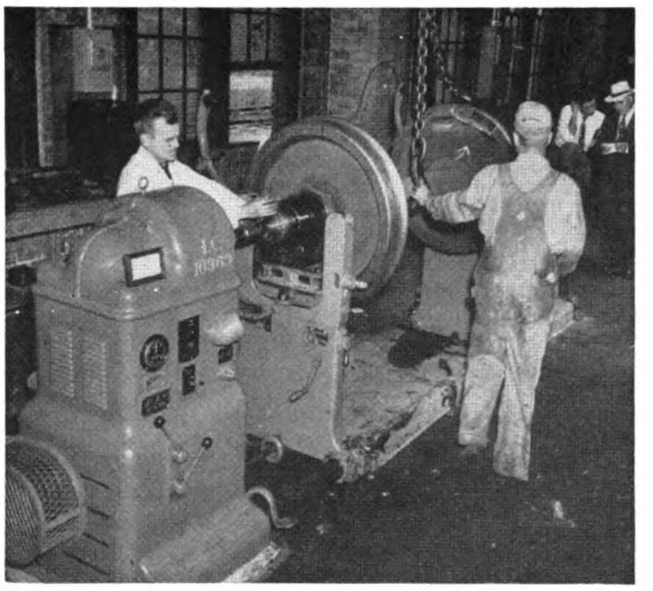
to accommodate a set of car wheels was a simple matter. Special flexing heads, equipped with adjustable roller bearings, made it possible to accommodate shafts of varying diameters. The distance between column supports, on the Bear machine, was adjusted to accommodate the greater length of the axle.

After many successful test runs and much research, the I. C. balanced all the wheels of its "Daylight Special," which runs on a mile-a-minute schedule between Chicago and St. Louis. Other balancing operations involved the wheels of several cars of the "City of New Orleans," as well as a number of specialty cars, such as observation-parlor cars, bar and lounge cars, diners, dormitory-tavern cars, mail and express cars, and power cars.

During this testing period, I. C. officials also found that, when Diesel locomotive wheels are dynamically balanced, higher-speed standards can be attained easier, and the trains perform better. Other benefits included savings in wear and tear on bearings and coaches in general, as well as on track.

Special Wheel-Balancing Set-Up

The results of experimental dynamic-balancing operations were so favorable, that the Illinois Central installed special wheel-balancing set-up in the Burnside car wheel shop. The operation is divided into three distinct phases, each being performed at a different station. The balancing machine, babbitt heater and scale bench and wheel-supporting stand, equipped with rollers, are located in one line along the shop wall with the wheel storage track just in front. The first operation is to lift the pair



Wheels in position on Bear balancer—Operator has started to lock axle to the flexing head

of wheels to be balanced with the shop crane and place it in the Bear machine where it is supported on flexible heads with adapters to suit axles of different diameter and also roller bearing races which do not have to be dismounted.

A safety hold-down is then clamped over the assembly which is revolved at the required speed, namely 325 r.p.m. for railroad wheels. An 1,800 r.p.m. motor and a four-speed transmission drives the machine which has a maximum speed of 1,000 r.p.m. A speed chart attached to the left top of the control tower specifies desired speeds for all railroad equipment parts likely to be balanced on this machine. A dial indicator on each support column indicates the amount of unbalance, and a round spark dial shows the position of unbalance.

The amount and location of unbalance in each wheel is obtained at one setting of the pair of wheels in the machine, after which this pair is released and moved by the shop crane to the wheel stand, shown, where they rest on rollers and may be readily revolved.

The first operation is to grind off all dirt and scale at a point under the wheel rim, as shown in one of the illustrations, where weight is to be added. This is done with a pneumatic hand grinder. The wheel is then revolved by hand while a gas torch is used to heat the wheel rim lightly all the way around. The spot where weight is to be applied is then carefully tinned, and revolved to the lowest point on the circumference. A piece of sheet asbestos backed up with thin sheet steel is then clamped to the inside vertical surface of the wheel rim.

In the meantime, an amount of babbitt metal equal to the unbalanced weight has been weighed out on the Fairbanks scale, melted by gas heating of a small ladle and poured into the prepared mold. When cooled this babbitt adheres firmly to the plate and underside of the wheel rim and, for all practical purposes, becomes a permanent part of the wheel.

The amount of dynamic unbalance in the wheel, illustrated, was 3 lb. 2 oz. and this amount of babbitt is shown applied to the underside of the wheel rim at the required spot to place this wheel in accurate dynamic balance.

Burlington Reclamation Practice at Eola, Ill.*



An important first step in welding malleable iron freight car journal boxes is through cleaning by burning off the oil and refuse at low temperature in the annealing furnace, which expedites sandblasting, permitting ready location of cracks. In building up the wedge seat surface and other areas subject to abrasion, a 3/8-in. bronze rod is used to provide a hard surface. Cracks and fractures are welded with a 1/4-in. bronze rod as it adheres to malleable iron and provides a strong weld

Out of many hundreds of items that are selected on a basis of definite savings as compared to the cost of new parts some car and locomotive parts offer opportunities to take advantage of modern welding technique

THE Burlington Reclamation Plant at Eola, Ill., occupies a floor space of 4,000 sq. ft., and employs 46 men, including 4 oxyacetylene welders and 7 arc welders. Included in the plant are a blacksmith shop, a tin shop and a machine shop. The plant is piped throughout for oxygen and for acetylene, the oxygen being served by a cascade of cylinders and the acetylene generated.

Parts to be reclaimed are shipped into the shop from the entire system. The sorting of materials received, and the decision as to what to reclaim, is the responsibility of the reclamation plant employees. While much reclamation is performed that does not require welding, the number of parts reclaimed by welding for the mechanical and other departments is about 175.

All reclamation of material is done on orders approved

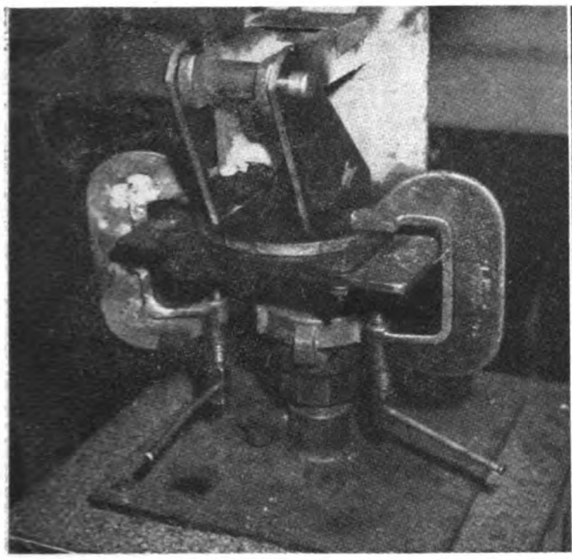
* Abstract of a paper presented before the American Welding Society by W. G. Muschler, superintendent reclamation and scrap, C. B. & Q.

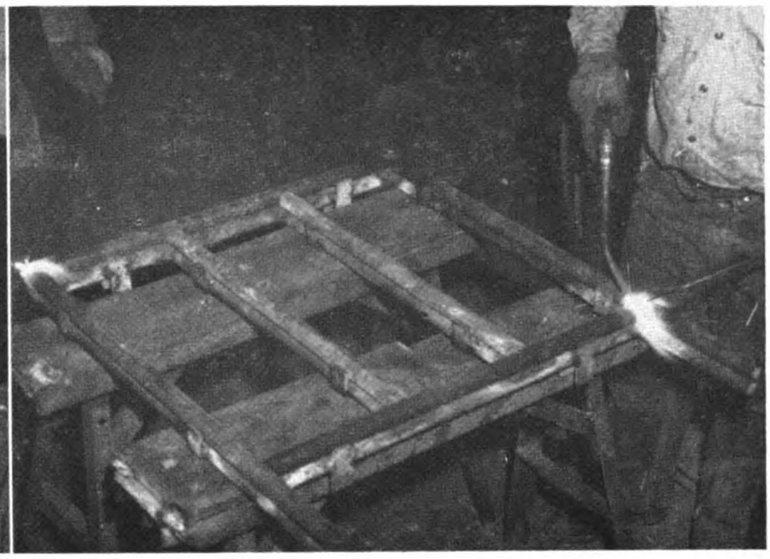


The amount of weld metal deposited is controlled accurately to minimize the grinding required. After completion of the dust-guard surface grinding, the box is ready for service with a saving of approximately 75 per cent of the purchase price

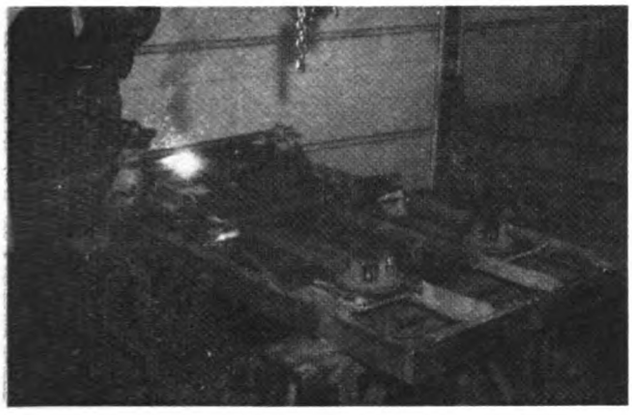


Oxyacetylene heating of a T-section for a warehouse truck preparatory to making a bend. T-section is 5/16 in. by 3 in., and the bend is heated in 15 seconds with a No. 80 tip





Left: In building the warehouse trucks it was found economical to weld up small sub-assemblies. The front swivel wheel assembly is shown in the jig ready for welding.—The back wheel assembly is made on the same jig. Right: Smooth welds which require no after finishing are obtained with the above procedure for welding 1-in. pipe for the end gates on the warehouse trucks. The jig for the operation is underneath the pipes being welded. A No. 40 tip is used with a 3/16-in. mild steel rod

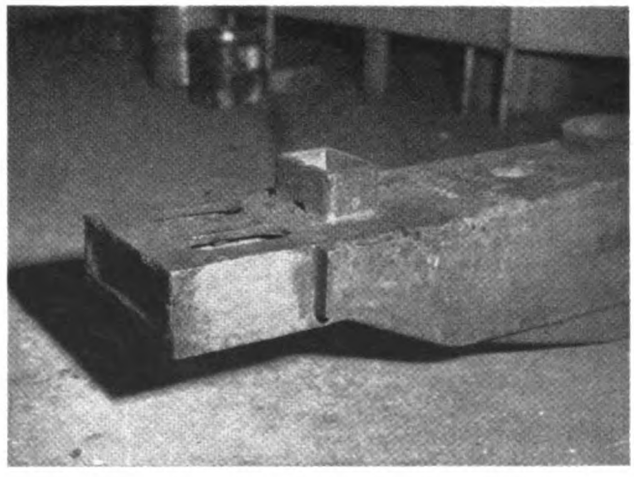


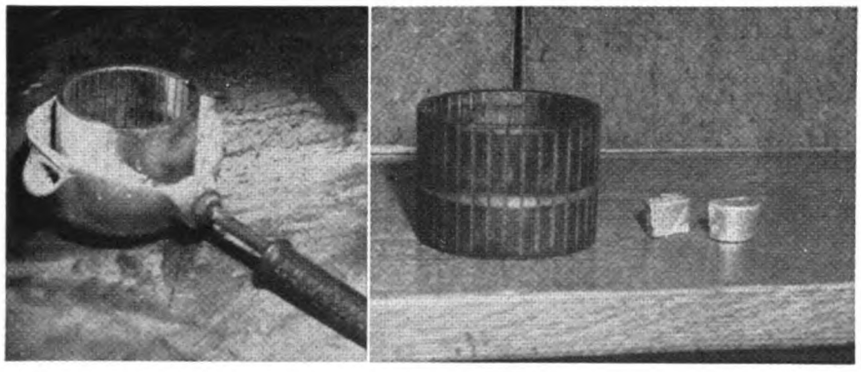
Above: Arc welding the base members of a warehouse truck frame on a special holding fixture, using E-6012 ¼-in. electrodes—Below: The all-welded warehouse truck, assembly procedures for which were shown in Figs. 3, 4, 5, 6 and 7, prior to spray painting and application of the wood deck floor



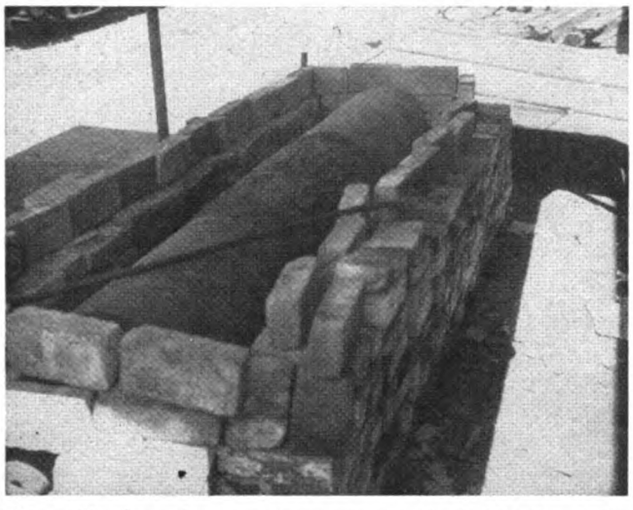
Above: The bend is made in the T-section by hand while it is red hot on the jig shown above—Below: Because building up worn surfaces of truck bolsters is permissible if the material remaining in the part is 60 per cent of the original section, and because there are no restrictions on welding cracks or fractures, a saving of 94 per cent is realized. The bolsters are built up with 3/16-in. and ¼-in. electrodes. Cracks and fractures were welded with ¼-in. E-9010 electrodes, providing a tensile strengh of 112,000 lb.







Left: Diesel wrist-pin bushings are de-silvered by placing the bushing in a cast-iron ladle and playing the acetylene flame from a No. 80 tip on it. The silver melts and flows into the ladle. Right: The molten silver is poured from the ladle into a sand mold that furnishes 16 round slugs of 99.9 per cent purity, the silver on one bushing making one slug. Also shown is one of the slugs sawed in half

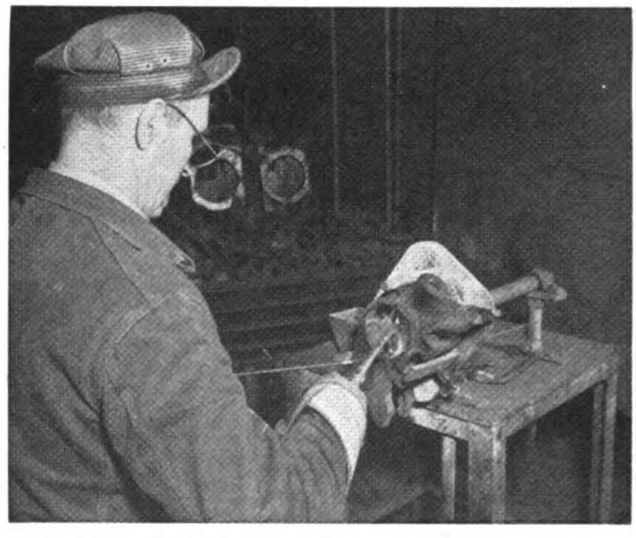


This cable drum for a gantry crane weighs 1,550 lb., is 14 in. in diameter, and 90 in. long with a grooved area extending 36 in. The decision to weld it was reached because it was too valuable to scrap, and replacement with a new drum would cause serious delay. Welding required a mild preheat of 700 deg., and the depositing of 215 lb. of ¼- and ⅜-in. cast iron rod with a No. 80 tip. The saving was approximately 75 per cent

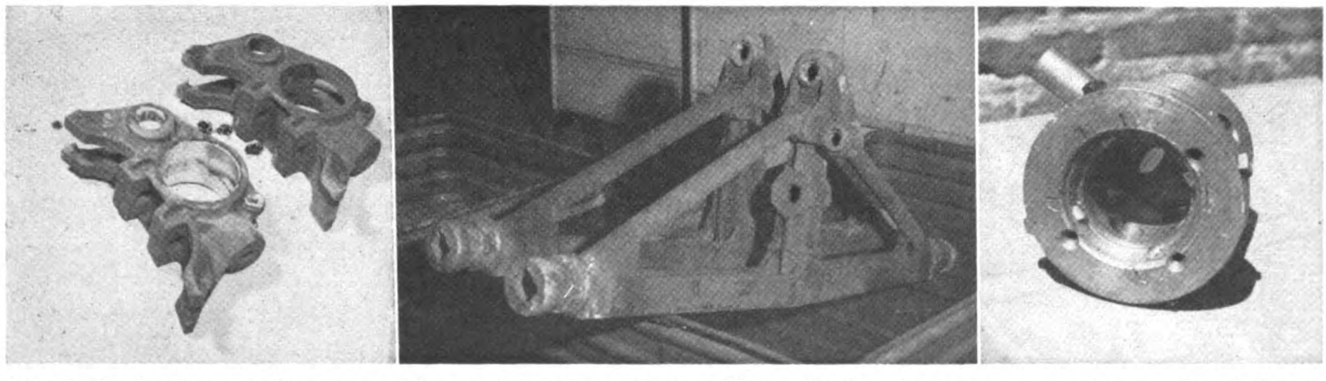
by the using department, or, if for stock, by the storekeeper. Material is not reclaimed in advance of properly approved order, nor merely to keep the plant busy.

Certain general practices are common to all operations. In all possible operations the work is positioned to permit downhand welding. Annealing, normalizing or stress relieving is done at a temperature rise rate of 500 deg. per hr., and then held at the specified temperature for one hour per inch of thickness. Annealing temperatures are 1,500 to 1,600 deg. F., and the material is allowed to cool to 500 deg. or below in the annealing furnace. Normalizing is done within the same temperature range, but the material is removed from the furnace and allowed to cool in still air with protection from drafts and weather. Stress relieving is done between 1,200 and 1,250 deg., and the material cooled in still air.

The illustrations show some of the operations at Eola, and the fixtures on which they are performed.

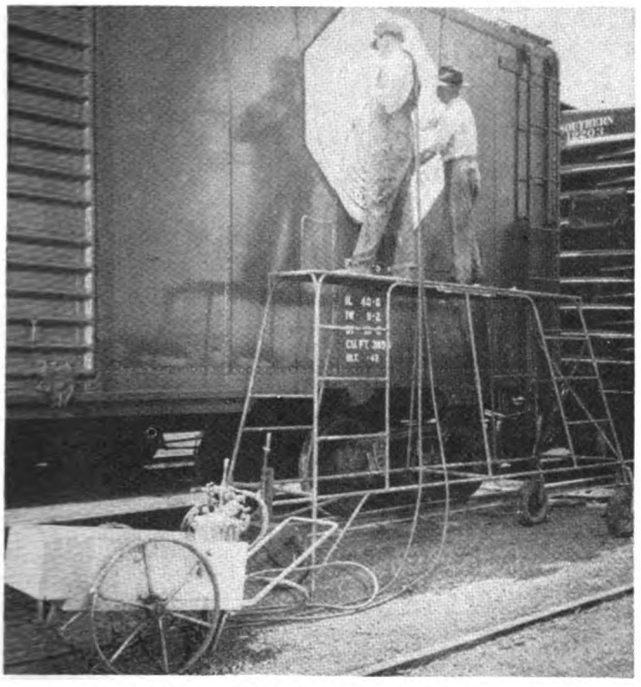


Building up a brake head in a turning jig with a No. 60 tip



Left: Brake heads are built up by welding, and bored out. Center: The ends of brake beam compression members built up with oxyacetylene, the rod used being ¼-in. No. 1 rolled steel. Right: Outside circular cutting tool devised for turning the built-up ends of brake beams to proper dimensions

Car Stenciling Portable Scaffold



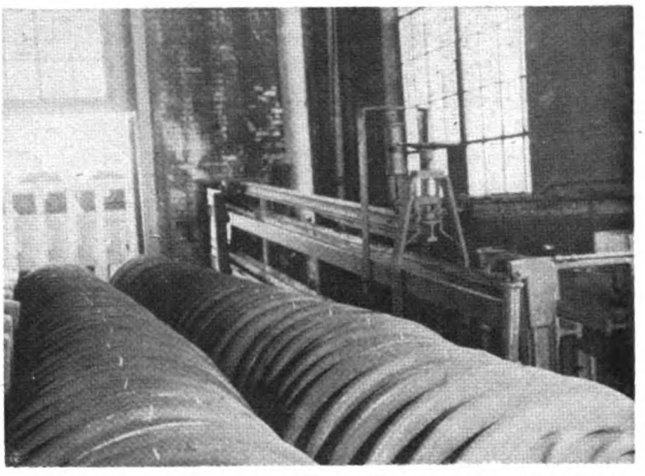
Portable scaffold for stenciling box cars

A portable scaffold has been built at the Spencer, N. C., shops of the Southern primarily for stenciling box cars. The scaffold is 6½ ft. high and rides on three pneumatic rubber tires 4 in. by 15 in. The rear tires are fixed while the front tire swivels and can be lowered for movement or raised for securing the scaffold in working position, the raising and lowering being done with a screw handle. When the front wheel is raised the scaffold rests on the two back wheels and on two front legs.

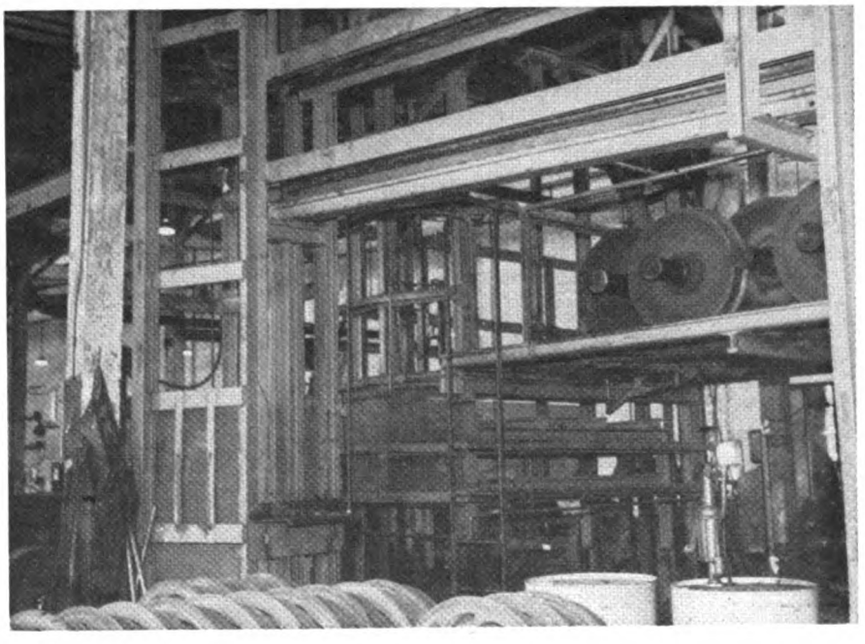
The platform is constructed of 1/16-in. plate, with the frame structure of ¾-in. pipe, and the steps and braces of ½-in. pipe. The wheel casters are ⅜ in. by 1½ in. Two other scaffolds used for similar work at lower locations are similarly built; one is 5 ft. high and the

Wheel Handling Using Elevated Runway

An elevated runway forms an integral part of the wheel handling system of the Grand Trunk Western's Port Huron, Mich. shops. The mounted wheel sets enter the



New wheels enter the shop along the runway at the right—Along the left is part of the wheel storage area which occupies the space between the runway at the right and the elevated runway for the incoming mounted wheel sets

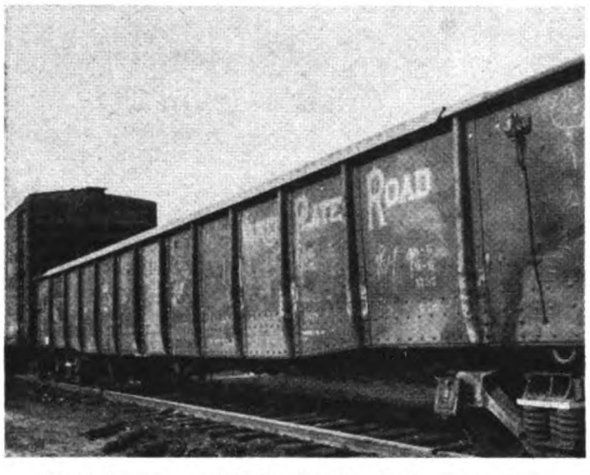


Elevated wheel runway with elevator which automatically lowers one pair of wheels at a time to a demounting press just beyond the end—To the left of the main elevator is a small hoist for moving demounted scrap wheels out of the shop along a runway for single wheels—The reconditioned wheel sets are rolled out of the shop on a floor-level track directly underneath the elevated runway

shop on the elevated runway and proceed to the far end where a trip releases one pair of wheels at a time. These are lowered by an elevator and rolled to a demounting press just beyond the end of the runway. Demounted scrap wheels are returned to the end of the runway and elevated by a hoist to a wheel runway on which they run by gravity out of the shop. The axles go to a rack on the side of the demounting press away from the runway. Reconditioned wheel sets move out of the shop on a floor-level track directly underneath the elevated runway.

New wheels enter the shop on another single-wheel runway along the wall, the space between this latter runway and he other two runways serving as a storage area for wheels. The new wheels are unloaded directly onto the chute from the car over a platform at the loading end of the chute at the level of the car floor. The two single-wheel runways have adjustable retarders to control the speed of the wheels.

Strengthening Gondola Top Bulb Angles



Gondola car on which the top bulb angle has been reinforced to prevent sagging and buckling

The top bulb angles on Mill-type gondola cars are being reinforced at the Nickel Plate Road's Conneaut, Ohio, shops to prevent them from buckling or breaking, a defect common to this type of equipment. The angle is stiffened against vertical as well as horizontal stresses by the reinforcement which extends from bolster to bolster and more than doubles the strength of the top chord against both vertical and horizontal loads. The reinforcement also indirectly strengthens the side sills and the center sill.

When existing bulb angles are removed, straightened and reapplied, a section of bar iron 1 in. by 4 in. is applied to the top of the bulb angle from bolster to bolster. The bar is tapered at the ends in order to avoid setting up abrupt stress points. Attachment is made by plug welding through ¾-in. holes in the center line of the bar, spaced 5 in. apart, and by riveting at intervals approximating post spacing.

When new bulb angles are applied, a section of bar iron ⅝ in. by 4 in. is used, and on top of this bar an angle ⅜ in. by 3½ in. by 5 in. is applied with the 5 in. leg horizontal. Both sections extend from bolster to bolster, and attachment is made as outlined above except that an additional row of holes is provided in the horizontal leg of the angle which is plug welded to the outside leg of the bulb angle. The car shown in the illustration has been reinforced in this manner.

Distributing Oil Evenly in Waste

The risk of dumping back in one spot all the oil that settles out of journal packing waste during storage is averted by an arrangement used at the Despatch Shops, Inc., East Rochester New, York. The packing is placed in one of two steel bins 8 ft. wide by 3 ft. deep by 2½ ft. high. The oil whch settles out of the waste drains into two clyinders 6 in. in diameter and 8 ft. long. These clyinders are mounted on a slight incline with one end 4 in. higher than the other.

Air pressure is applied directly to the high end of the cylinder and forces the oil into a rubber hose which is attached to the low end. The discharge end of the hose is fitted with a spray nozzle, and it is thus a simple matter to spray the oil evenly over the entire top of the waste contained in the bin.

The waste is first saturated in an adjacent oil house



Arrangement for evenly distributing the oil which settles out of stored waste

and carried to the oiling room in barrels. It is placed in bins for overnight storage at 100 deg. Before packing is begun in the morning the top layer of the waste is sprayed, allowed to stand about 15 min., and formed into rolls. The waste is sprayed throughout the day between the packing of each set of four journals on each truck.

Full-line air pressure is available at the control valve for spraying the oil, but the valve is only cracked about 1/16 of a turn. A globe valve is incorporated between the drainage clyinders and the waste storage bin. This valve isolates one from the other when the air pressure is on during the spraying operation, and prevents dissipation of the air pressure through the bin.

Altitude Performance of Electro-Motive Model 567 Engine*

The results of tests made to determine the tractive force available for traction at varying elevations from 500 to 10,000 feet

By H. W. Barth†
D. M. Lyon† and
R. B. Wallis†

THIS PAPER is presented to describe certain tests of the General Motors 16-567B diesel engine, performed by the Engineering Department, Electro-Motive Division, General Motors Corporation. The primary purpose of the tests was to study the variations in horsepower available for tractive force as affected by altitude and temperature conditions.

The General Motors 16-567B is a 16 cylinder, 8½-in. x 10-in. uniflow, two stroke cycle, 45 deg. V engine. It is centrally mounted in the Model F7A locomotive and is directly coupled to the main generator. Fastened integrally to the main generator shaft is an alternator which supplies the power for radiator cooling fans and traction motor blowers. The output of the main generator in normal operation is entirely absorbed by the four axle hung traction motors. Mounted on top of the main generator and driven from an additional power take off from the engine timing gears is an auxiliary direct current generator for battery charging, field excitation, and controlled power. Coupled to the rear end of the main generator is the locomotive air compressor. All of these power absorption units are fixed to rotate whenever the engine is running and are loaded or not as required by their specific duties. The engine operates at a given speed and fuel rate for each of the eight positions of the operator's throttle. The speed and fuel rate are pre-set in the engine governor adjustments and a regulator adjusts the engine load to utilize the power available at these settings. Thus, the fuel supplied under fixed throttle conditions remains constant regardless of the load demands of the locomotive auxiliaries or the draw bar.

The Model F7A on which this engine was installed is a single locomotive lead unit. It was complete with cab and all operator's controls and may be used in service alone or in conjunction with additional units. Prior to the time that any engine tests were made, it had been operated for approximately 20,000 miles for the purpose of experimenting with the electrical switch gear. This period permitted a good shakedown of the engine and allowed time for the running in of all parts.

The principal study of variations in horsepower as affected by altitude required tests at 10 sites ranging in geographical altitude from 500 to 10,000 ft. in 1,000-ft. increments. The test sites in order of their elevation were: the Electro-Motive plant, La Grange, Ill.; Parsons, Kan., on the Missouri-Kansas-Texas; Hastings, Neb. and Wray, Colo., on the Chicago, Burlington & Quincy; and on the Denver & Rio Grande Western, Denver, Colorado Springs, Salida, Buena Vista, Granite, and Tennessee Pass, all in Colorado.

Plans were made to control as many variables as possible. The first problem was to keep the locomotive stationary, and thus at a fixed altitude, during the test runs

* Abstract of a paper presented at the Society of Automotive Engineers, National Diesel Engine meeting, Chicago, November 2 and 3, 1950.
† Electro-Motive Division, General Motors Corporation.

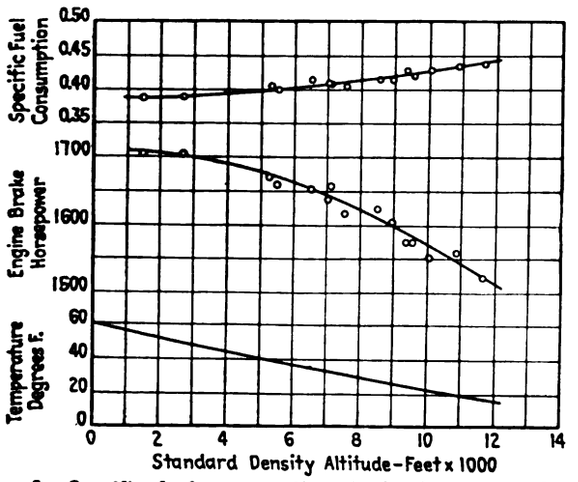


Fig. 1—Specific fuel consumption, brake horsepower in relation to density elevation

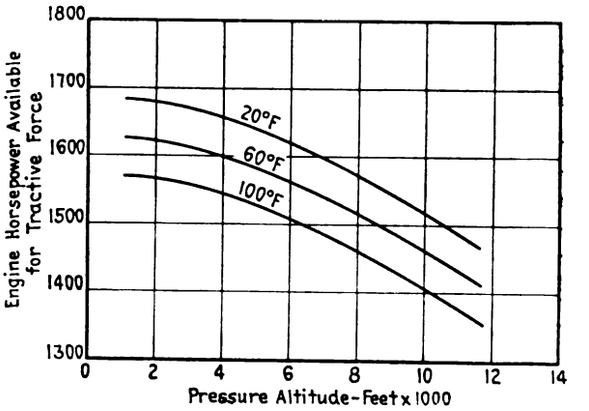
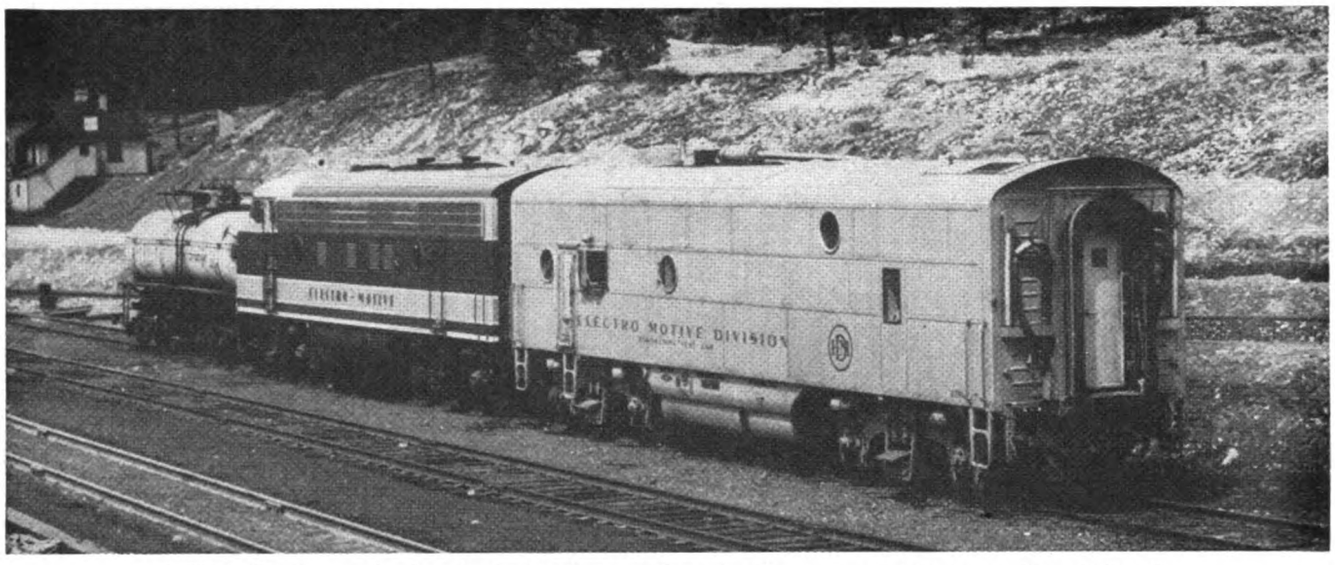


Fig. 2—Available engine crankshaft horsepower related to pressure altitude



E.M.D. F7A locomotive A unit, fuel tank car and engineering test car at Tennessee Pass, Colorado

at each site. Since the traction motors cannot absorb the full energy output of the engine while the locomotive is stationary without overheating, the output of the main generator was connected to the resistor grids of the dynamic brake hatch. These grids, which are part of the locomotive's regular braking system, are of ample capacity to dissipate the full power output of the engine in the form of heat.

The second problem was to provide uniform fuel for the tests. The locomotive fuel tank had not sufficient capacity to carry the fuel required for all the tests. To provide uniform fuel a tank car was coupled to the locomotive. Fuel for all the tests, providing data for this report, was drawn from this tank car.

All instrumentation was incorporated in a test panel within the locomotive car body. A photograph shows the pressure gauge panel, the exhaust temperature indicator, and the fuel scale and timing equipment by which the fuel rate was determined. The exhaust temperature indicator was a 40-point Leeds and Northrup Speedomax Indicator. The fuel weighing device consisted of a 125-lb. platform scale supporting an 18 gal. fuel tank. The beam of the scale was equipped with a mercury switch which closed at the beginning and ending of a weigh period. This switch operated relays which started and stopped a 1/100th min. timing clock. Electrical meters, used to indicate the power output of the main generator, the auxiliary generator, and the alternator, were located in the table and covered with a transparent plastic table top. This plastic top permitted the use of standard Weston Model 45 portable meters, without exposing the operators to the high voltage connections.

Oil, water, and engine temperatures were recorded on a 16-point Leeds and Northrup Speedomax recorder. This replaced the Micromax which was found to perform unsatisfactorily. Beneath the recorder was mounted the electronic converter which supplied 60 cycle a.c. current to the temperature indicating and recording units and to the fuel timer.

The fuel used on the test was procured through the Denver & Rio Grande Western from the Bay Refinery Company of Denver, Colorado, and was of high quality paraffinic stock with a cetane number of 59. A complete laboratory analysis of the fuel is shown in the table. This fuel was cleaner, higher in cetane number, and lower in sulfur than the majority of fuels currently used in railroad service.

The general procedure at each test site was similar. After the locomotive had been placed on a siding, the elevation of which was as close as possible to that called for by the pre-determined altitude schedule, operating checks were made of the engine and equipment before any data were taken.

The test at each site was designed to determine the engine horsepower in each of the eight throttle positions at the altitude at that site. The steps taken were as follows:

1. The engine was operated at full power for one hour to bring it to an equilibrium condition.
2. Readings were then taken of the power output, fuel rate, and principal temperatures and pressures. Second and third readings were made ten and twenty minutes later, respectively.
3. After completing the third full power readings, the throttle was reduced by one position. The engine was then operated thirty minutes at this speed after which three readings were made with the same time interval as before.
4. This process was repeated for each of the throttle positions.

A large number of readings was taken during the various tests. The data thus collected have been studied in an attempt to determine the actual changes in the engine performance. These data showed marked differences in power output at the different elevations. It is important to realize, however, that it is not the number of feet above sea level itself which causes these differences, but the differences in air density. While changes in elevation will themselves affect air density, air density at any given elevation is also affected by variations in temperature and pressure. As a result, readings taken at the 1,000-ft. geographical elevation—or at any other elevation—will change as temperature and/or pressure changes. Accordingly, the air density at each site was calculated and the horsepower developed was plotted against an elevation which corresponded to this air density.

In making the calculations of air density, the barometric pressures and free air temperatures were used.

Standard density altitudes were based on standard elevation pressures and a uniform temperature lapse rate of 59 deg. F. for sea level minus 3.566 deg. F. for each 1,000 ft. in elevation. Where the pressure altitude is accompanied by a temperature which is equal to the lapse rate temperature, the pressure and density altitudes are equal. The bottom curve in Fig. 1 shows this lapse rate temperature. The significance of using the air density as a measure of altitude is shown by the fact that Tennessee Pass, which is 10,424 ft. above sea level, had, on the day the test was performed there, a density altitude of 11,600 ft.

The middle line of Fig. 1 shows the curve that resulted from plotting the horsepower in relation to changes in density altitude. This curve represents total brake horsepower and includes the power required for the various locomotive auxiliaries as well as the power available for tractive force.

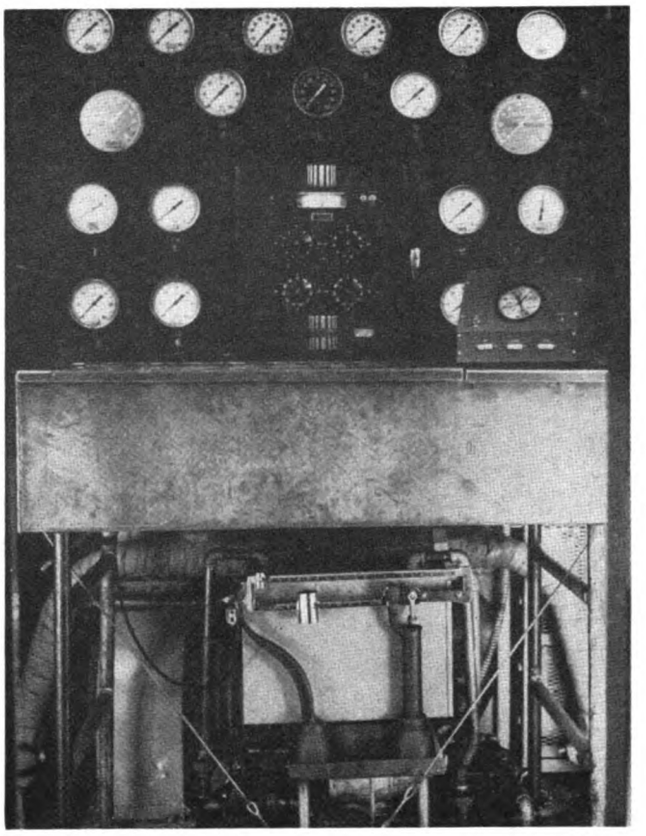
The curve indicates that there was practically no change in horsepower from sea level to 2,500 ft. Between 2,500 and 5,000 ft. a decline in horsepower became evident. It reached a rate of decline of about 20 hp. per 1,000 ft. for this 16-cylinder engine at altitudes above 5,000 ft. At any elevation additional fuel would give additional horsepower. This additional horsepower, however, is not proportionate to the additional fuel supplied.

Diesel Fuel Analysis—Fuel Used on E.M.D. Locomotive No. 930 During Horsepower Study—(Sample No. 0-3140)

Method of test	E.M.D. result
A.P.I. gravity at 60 deg. F.	38.5
Specific gravity at 60 deg. F.	0.832
Weight in lb./gal. at 60 deg. F.	6.93
Flash point, deg. F.	175
Conradson carbon (10 per cent Resid.) per cent	0.04
Viscosity at 100 deg. F., Saybolt Universal, Seconds	38.0
Viscosity at 100 deg. F., Kinetic	3.65
Acid and base number	0.00
Aniline Point, deg. F.	177
Bromine number	1.7
Specific dispersion	116
Thermal value, B.t.u. per lb.	19,750
Cetane number	59
Diesel index	68.5
Total sulfur, per cent	0.09
Copper strip corrosion test, at 212 deg. F.	Neg.
Cloud point, deg. F.	+25
Pour point, deg. F.	+5
Water and sediment, per cent	None
Color (union)	(Pink)
Ash, content, per cent	0.00
Gum content, mg. per 100 c.c.	63
Thermal value	
B.t.u. per gal.	135,750

The top line in Fig. 1 represents the specific fuel consumption in relation to the density elevation. The specific fuel consumption is a function of the brake horsepower output. It began at La Grange with .385 lb. per brake horsepower hour and reached .435 lb. per brake horsepower hour at Tennessee Pass. Since the weight of the fuel injected in pounds per hour remains constant for a given throttle position, the change in specific fuel consumption is inversely proportionate to the change in horsepower.

Figure 2 is composed of three curves showing engine crankshaft horsepower available for tractive force as related to the pressure altitude. These curves show the horsepower which was available in the test locomotive and should be adjusted to rated horsepower for applications to other locomotives. Since these curves are for constant



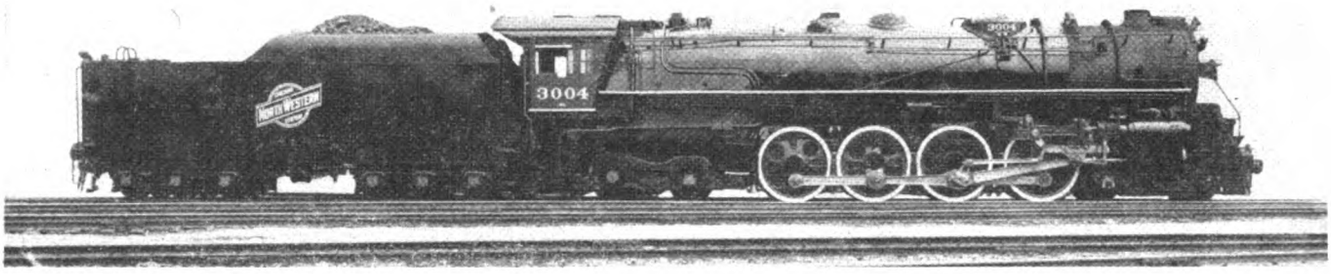
Test panel in locomotive includes pressure gauges, exhaust temperature indicator, fuel scale and timing equipment

temperature and are parallel to each other, the expected horsepower for a locomotive under any particular pressure altitude and temperature conditions may be determined.

Some information was obtained in the tests in addition to that presented in Figs. 1 and 2. It was observed that the heat rejection in the exhaust gases remained nearly constant at all altitudes. This was accompanied with an increase in the average exhaust temperature from 800 deg. F. at sea level to 1,000 deg. F. at the maximum altitude. In this particular engine, the heat rejection of the exhaust amounted to about 70,000 B.t.u. per min. There appeared to be a slight increase in the heat rejection to the cooling water between the low and high altitude extremes. The rejection was 56,000 B.t.u. per minute at La Grange and 63,000 B.t.u. per minute at Tennessee Pass. There was an indication of a slight increase in the heat rejection to the lubricating oil. However, the change in temperature recorded was within the error of the recording instrument and, therefore, will not be considered significant in this report. The heat energy converted to work amounted to 73,000 B.t.u. per minute at La Grange as against only 65,000 B.t.u. per minute at Tennessee Pass. This is a decrease in the thermal efficiency from 33 to 29.4 per cent.

Three cooling fans were required for all full load power runs even when the high altitude outside temperatures were as low as 32 deg. F. This may be explained by the decrease in the mass rate of air handled by the fans under high altitude conditions. The air box charging pressure of the engine declined from 7.6 in. to 6.36 in. of mercury. The ratio of these two pressures indicates that the air

(Continued on page 70)



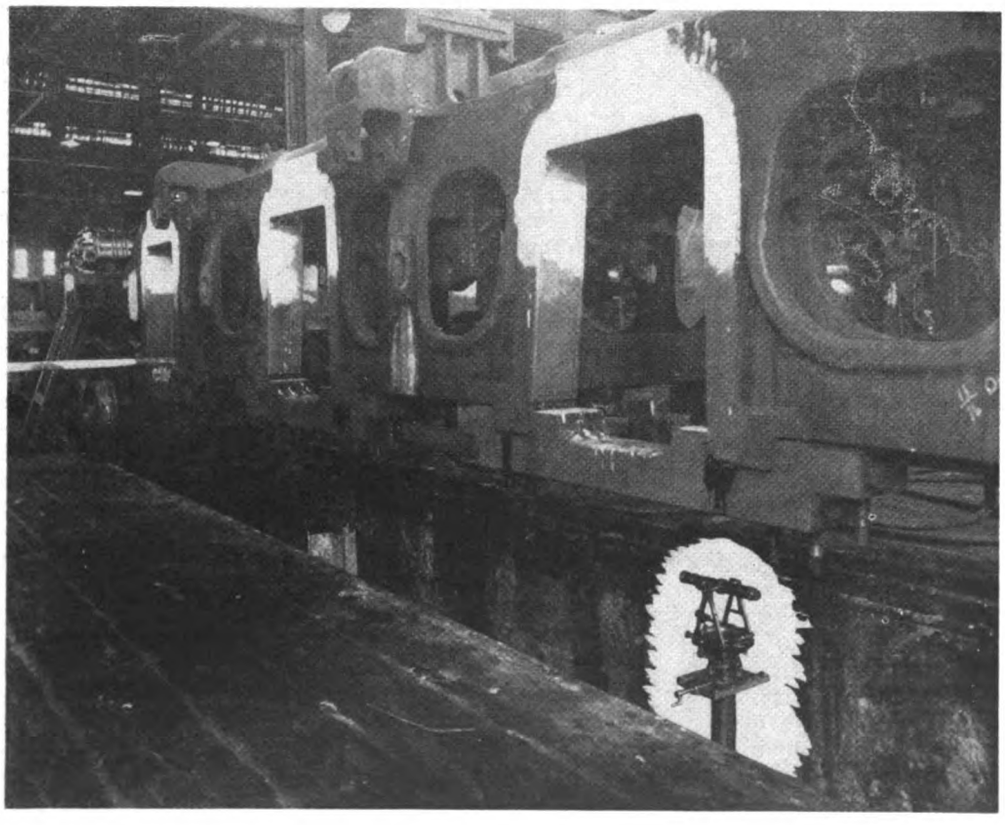
North Western locomotive 3004 which has covered over 360,000 miles without shopping with the machinery still in excellent condition and suitable for at least one more year's service

Transit-Aligned Steamers Need No Shopping After Four Years

THE Chicago & North Western locomotive 3004, the first of the Class H heavy 4-8-4's to be modernized completely and laid out with a transit,* has recently undergone its fourth annual inspection after accumulating over 360,000 miles, mostly in freight service. During this entire period the locomotive has neither received nor required any classified repairs. The machinery is still in excellent condition and suitable for at least one more year of service. Some of the outstanding wear records of this locomotive and others of its class, no small part of which is due to the precision layout made possible by the transit, are given below.

Tire life on the first set of tires was 180,122 miles, on the second, 150,228. The third set was put on Jan. 20,

* For complete description of the transit method procedures and results see Railway Mechanical Engineer of Dec. 1949, page 713.



Tha beginning of good performance and high availability—The above view of the transit in the pit is the first step in this accurate layout method

1950 and has over 40,000 miles. The tires are still a full four inches with no flanging and only 1/16-in. tread wear. Mileage between Lidgerwooding has been as high as 115,348. Some of the other H-1's have gone as high as 225,000 miles on a set of tires.

The cylinders on the 3004 and all other H-1's still use 27-in. packing; no cylinder boring has been necessary on any of the 23 H-1's. Most H-1's still use the original size 14-in. valve packing. The 3004 has just recently had 14 ⅛-in. packing applied. As the maximum size permitted is 14-⅜ in., no valve bushing difficulties are anticipated.

Both the valve guides and the main guides are still in good shape. The valve guides still have a 1/16-in. shim. The main guides are in excellent condition and are expected to last for many years. The crossheads are re-babbitted annually as a matter of course.

All original shoes and wedges are in use on all H-1's, and the same is true of the floating plates on the No. 1 and No. 4 drivers. The 3004 and one or two of the other highest mileage H-1's have had ⅛-in. oversize floating plates applied to the No. 2 and No. 3 drivers. Three new crank pins have been applied to the 3004, both No. 1's and one No. 4. The main, the No. 3's, and the one No. 4 were those originally applied in 1946 and are still in satisfactory condition. Most H-1's still have all original crank pins.

A crank pin witness groove is cut in the wheel hub about 1½ in. out from the surface of the crank pin. This witness groove is cut by the quartering machine in the back shop when the wheels were turned and pins quartered at the time the locomotive was modernized. The witness groove locates accurate quarter on each wheel and is used in setting the portable crank pin grinders and turning machines when truing of pins is required by enginehouse forces.

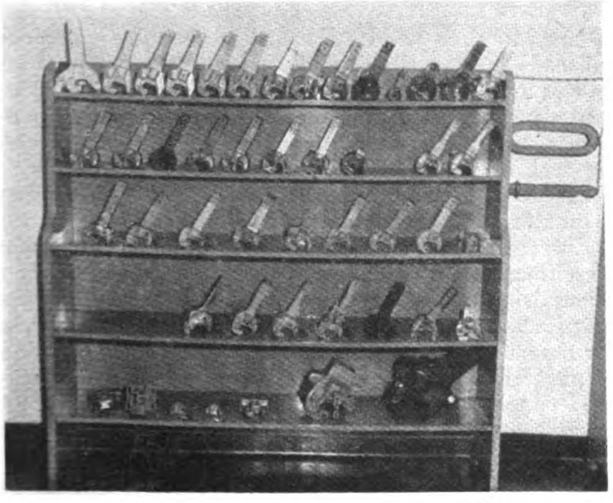
One steel rod bushing, the right No. 4, is the only recorded replacement in four years of service. Bronze bushings are replaced as wear develops but do not generally need attention between annual inspections. The motion work is in excellent condition, with no appreciable wear, no pitting or grooving.

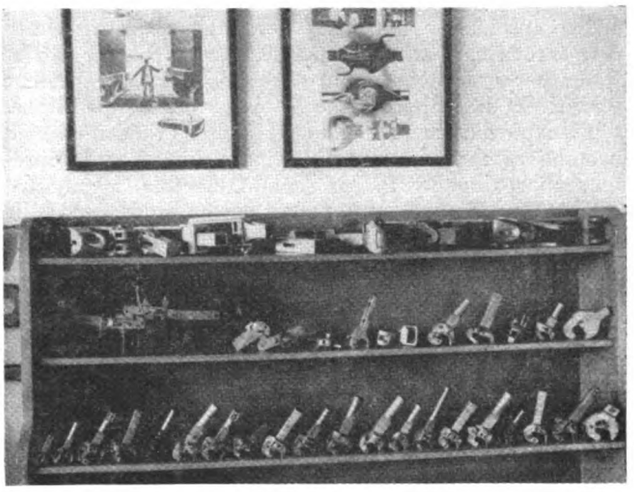
The silico-manganese coil springs used at the front of the front drivers and at the rear of the rear trailer wheels are still in good condition and none have required renewal. Lateral difficulties are virtually non-existent. The H-1's are given ½-in. free lateral on the front drivers. The 3004 with over 360,000 miles has only ⅝-in. lateral. The only maintenance required has been to renew lug liners.

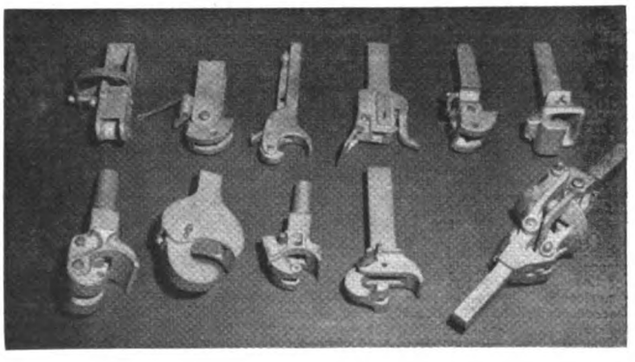
One of the outstanding characteristics of the H-1 locomotives has been the almost complete absence of flanging. This is attributable to two principal factors. One is the precision alignment attained with the transit layout and the second is a procedure followed at each annual inspection. The latter consists of dropping and dismantling the engine truck to inspect and repair the rockers and rocker seats.

The only machinery repair of any consequence made to the 3004 has been the application of the oversize floating plates at the No. 2 and No. 3 drivers. The only time any wheels were dropped on any H-1 was to renew lug liners; tires are shrunk on with the wheels in place and are turned by Lidgerwooding.

Flue extensions to 5 years of service have been granted the first two Class H-1 locomotives to complete 4 years of service. Plans are to request flue extensions for each H-1 as it completes 4 years of service.







A permanent exhibit of scale models of car couplers at the offices of the National Malleable & Steel Castings Co., Cleveland, Ohio. The history of coupler developments is traced from pre-Janney days down through the various steps in vertical-plane coupler development to present-day standards. Examples of the Millerhook and the link-and-pin types are also included.
Car coupler history

Diesel Engines or Gas Turbines For Locomotives*

Author contends there is not yet sufficient factual evidence to establish fact that the gas turbine is or will be more economical or attractive for general railway use than the diesel.

By N. C. Dezendorf†

LET us consider known facts in relation to the diesel-electric locomotive and compare them with the rather optimistic guesses being made for gas-turbine-driven motive power.

As to locomotive weight, adhesion imposes a natural and positive limit to the amount of horsepower it is worthwhile installing on any given weight of locomotive. If the unit is to operate on a comfortable margin of adhesion without the wheels slipping, the maximum tractive force should not exceed approximately 20 per cent of the locomotive weight on drivers.

From considerations of the maximum ruling grade (generally of the order of 2 per cent) and the relation between the speed on the maximum grade and the speed on the level, which are basic factors, there is no advantage for general-purpose railway use, in reducing the locomotive weight below 150 lb. for each horsepower of prime mover measured at the wheel. Locomotives designed specifically and only for high-speed passenger applications can, with advantage, have a higher horsepower per unit weight, but such applications represent a relatively small percentage of total railway operations.

It is typical of current standard designs of diesel-electric locomotives that the diesel engine prime mover represents approximately 15 per cent of the total locomotive weight. The General Motors two-cycle engine, which is the most widely used in the world, on a typical 1,500-hp. locomotive, weighs only 30,000 of a total locomotive weight of 240,000 lb. There is little merit, therefore, in the potential lighter weight of the gas turbine prime mover since, even if such weight reduction can be achieved, it is of doubtful value for general-purpose locomotive use.

Largely offsetting any potential reduction in the weight of the prime mover is the increased weight of the fuel required due to lower efficiency. A typical 1,500-hp. diesel locomotive has a fuel tank of 1,200 gal. capacity. Including the weight of the tank, this corresponds (at 10 lb. per gal.) to 12,000 lb. total. For the same mileage the corresponding tank with fuel on a gas turbine locomotive must weigh 28,000 lb., an increase of 16,000 lb. This weight, too, is variable which in turn creates adhesion problems.

Initial Cost

On a typical locomotive, the cost of the diesel engine prime mover represents only about 20 per cent of the total locomotive cost. Any saving, therefore, in the cost of the prime mover will affect only a small proportion of the total locomotive cost. If the cost of the power unit were halved, the cost of the complete locomotive would, therefore, only be reduced by 10 per cent. It is perhaps noticeable that claims for such reduction in cost have rarely been made by manufacturers who have built either type.

Since the prime mover represents a relatively small proportion of the total cost of the locomotive, the annual debit for depreciation and interest on capital is not likely to be greatly different for either a gas-turbine or a diesel-electric locomotive.

Cost of operation

According to well-established accounting practices, railroads customarily include engineman's wages, fuel, lubricants, other supplies, repairs, and enginehouse expense, in the cost of locomotive operation. For the purpose of this comparison, the significant elements of cost are fuel, lubricants and repairs.

In order to make a fair comparison, it is necessary to predicate a size of locomotive unit.

Currently and for several years past, the most popular diesel locomotive unit built and purchased in the United States is a four-axle, 1,500-hp., 230,000-lb. locomotive unit, suitable for general traffic use, but in particular for the class of freight service which constitutes the bulk of the traffic of U. S. railroads. Such a unit is normally used coupled 2, 3 or 4 in multiple, giving 3,000, 4,500 or 6,000 hp., respectively, controlled from one operator's cab.

Potential high power output from gas turbines may encourage the development of gas turbine locomotives having powers higher than 1,500 hp. per unit. There is at this time no clear reason why such units should be more economical either to build or operate, except for some special applications such as high speed passenger work. Accordingly, for our comparison, we select a 1,500-hp., four-axle, 230,000-lb. general-purpose locomotive.

Fuel Costs

As presently developed, all gas turbines are operating either on gas or liquid fuels, but there is substantial interest in the use of coal in gas turbines. Assuming a satisfactory and reliable piece of equipment, the use of

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* Conclusion of a paper presented in a round-table discussion at the Pan American Railway Congress, Mexico City, October 10 to 20, 1950. Mr. Dezendorf credits H. G. McClean, export manager of Electro-Motive with assistance in the preparation of this paper.

† Director of sales, Electro-Motive Division, General Motors, LaGrange, Ill.

the gas turbine will be dictated, in large measure, by its economy. This is normally a combination of thermal efficiency and the unit cost of fuel.

There are places where the relative cost of coal fuel and oil fuel give substantial advantage to the former. This has, naturally, inspired attention to and research in the production of a coal-fired gas turbine. Additional and substantial engineering problems are involved as it superimposes on the problems of the gas turbine itself, difficulties in powdering the solid fuel, removal of objectionable material such as grit, and keeping the temperature down so that fly ash will not melt and form a slag on the turbine blades. Experimental work on the coal-fired gas turbine is presently being undertaken jointly by a group of American coal interests and locomotive builders, and also by Brown Boveri in Switzerland.

It may be noted, however, that on the basis of both availability and cost, the differential between coal and fuel oil appears to be moving in favor of liquid fuel. Accordingly, in the following study, it is assumed that the gas turbine will operate on oil fuel.

The General Motors 567-B diesel engine, so widely used in U. S. locomotive applications, has a thermal efficiency at full load of not less than 35 per cent and this efficiency is sustained over a wide range of loads. The efficiency of the electrical transmission will be substantially the same for either diesel or gas-turbine locomotive and may, therefore, be disregarded for comparative purposes. (Actually the transmission efficiency is likely to be sustained at over 83 per cent from full locomotive speed down to 20 per cent of full locomotive speed and under the best circumstances, may in this speed range rise to 86 per cent.)

No locomotive gas turbine within sight is likely to have a peak efficiency as high as 24 per cent, and even this will represent a substantial step forward on the examples at present in service for which the maximum known claimed efficiency is 18 per cent. However, this is a peak efficiency occurring only at the selected useful peak load for locomotive service. At less loads, the efficiency falls substantially and rapidly, so that, for example, the consumption at idling is approximately five times that of the corresponding diesel engine. All factors considered, it is reasonable to assert that the average thermal efficiency of the locomotive gas turbine—corresponding to a peak efficiency of 24 per cent—is not likely to exceed 15 per cent within the foreseeable future.

Therefore, in similar service the fuel consumption of the assumed gas turbine locomotive unit will be in the same relationship as the respective thermal efficiencies (35/15) or 2⅓ times that of the diesel locomotive.

Latest values of fuel consumption for many hundreds of 1,500-hp. diesel locomotives operating on railroads in the United States, is 1.8 U. S. gal. per locomotive unit-mile. Currently the price of diesel fuel as used for locomotives is stable in the United States at approximately 10 cents per U. S. gallon. Fuel cost is, therefore, 18 cents per locomotive unit-mile.

Several variables must be considered in arriving at an estimate of the unit cost of fuel for a gas turbine locomotive. While it seems probable that a grade of Bunker C fuel will be used, this expression covers an extremely wide range of fuels and only the better fractions are likely to be suitable for gas turbines. Improvements in refining processes will tend to reduce the availability of the unwanted and low-price fractions. The unit price varies widely depending on geographical location in relation to oil fields, transport costs, and the demands of local industry. Bearing all the above factors in mind, it is assumed for the purpose of this comparison that Bunker C fuel may be generally available in the grades requisite for gas turbine operation at 5½ cents per U. S. gallon.

For the gas turbine locomotive, therefore, by applying the ratio of efficiency to the fuel consumption of diesel locomotives of 1.8 U. S. gal. per locomotive unit mile, we deduce a fuel consumption of 4.2 U. S. gal. per locomotive mile. At our assumed cost of 5½ cents per gal., this corresponds to a fuel cost of 23 cents per locomotive unit mile.

Cost of Lubricants and Repairs

For our unit of comparison, the 1,500-hp. locomotive, the lubricant cost of many hundreds of existing U. S. diesels is 1.5 cents per unit mile.

There may be some justification for the claim that lower lubricant cost will be an advantage of the gas turbine, due to the fact that it is a rotary engine without cylinder liners, pistons and other moving parts. However, it must be remembered that the lubricant cost includes electric generators, traction motors and running gear, much of which is common to both locomotive types.

Therefore, it would appear generous in favor of the gas turbine, if we assume, for a locomotive unit with this type of prime mover, a lubricant cost of 0.5 cents per unit-mile, thus granting a saving of one cent a mile.

The repair cost per locomotive unit mile for the chosen 1,500-hp. example, taken from records of many hundreds of U. S. diesel locomotives, is 10 cents total, of which 4½ cents relates to the prime mover and the remainder to the electrical transmission equipment and running gear, which will be common to either type. It is a claim in favor of the gas turbine, as yet unproven, that the prime mover repair costs will be lower than for the diesel engine.

In the case of the diesel, it must be recalled that parts are produced in large quantities and at low cost. Maintenance operations proceed on a mileage basis and unexpected failures are usually confined to one cylinder of a multiple cylinder engine, and repairs to which can generally be made with a minimum disturbance to the prime mover as a whole. On the other hand, failure of, say, an individual turbine or compressor blade, may strip a complete stage; the blades are made of expensive material and renewal may involve substantial dismantling of the turbine or compressor and other items of adjacent equipment.

Therefore, it would seem generous to the gas turbine claims if we assume a 40 per cent reduction of the prime mover repair cost which will be only 2 cents per unit mile, a total of 8 cents for the complete unit, compared with 10 cents for the complete diesel.

COMPARISON OF TOTAL OPERATING COSTS PER 1,500-HP. LOCOMOTIVE-UNIT-MILE

	Diesel actual, cents	*Gas-turbine estimated, cents*
Fuel	18.0	23.0
Lubricants	1.5	0.5
Repairs	10.0	8.0
Total	29.5	31.5

Therefore, the increased fuel cost of the gas turbine, at the values taken for this comparison, due to its lower efficiency, can hardly be recovered by reduced lubricant or repair costs despite the use of cheaper fuel. It must, furthermore, be remembered that the above figures for

diesel electric are factual, but in relation to the gas turbine they are optimistic figures which still remain to be proven.

Operating Problems

There are also operating difficulties still to be solved for gas-turbine locomotive applications. Variations in ambient temperature will cause substantial variations in the engine output. A temperature rise of 100 deg. F. may represent a power loss of 40 per cent.

It is necessary to study at least two sets of conditions. In the first, we may consider a railroad having relatively constant daily temperature between summer and winter. In the second condition, we must consider railroads operating generally in hilly country where in a matter of hours the operating conditions may change substantially in temperature and altitude. In either case wide variation in power availability is undesirable. For the diesel locomotive these problems are solved. For the gas turbine locomotive they remain unsolved.

Examples of other operating problems readily occur, such as fire risk due to high temperature exhaust on lines with timber-lined tunnels, structures or over bridges.

New difficulties will arise, in considering public amenity, from the introduction of the new prime mover.

The elimination of noise is a big problem, due to the large volume of air required for gas-turbine operation and the noise level associated with high-speed rotating equipment.

The air intake, filtering and exhaust equally present problems in public amenity for which no easy solution is apparent.

General Conclusion

For general railway service, and in the face of the established and proven economies of the diesel locomotive, there is not yet sufficient factual data to establish that the gas turbine is, or will be, more economic or attractive.

There seems, furthermore, little immediate prospect that the gas turbine will establish such outstanding economic advantages compared with the diesel, to justify the premature claim that the proven economies of the diesel locomotive will be quickly surpassed.

Operational problems, such as variations in output with variations of temperature and altitude, and sustained high efficiency over a wide range of loads may take some years to solve. A gas-turbine locomotive would still retain all the electrical equipment and running gear of the existing diesel locomotive, representing perhaps 80 per cent of the whole in terms of initial cost and annual charges such as interest, depreciation and maintenance.

The main features of the gas turbine, such as light weight and small size, have no particular advantage in the locomotive application. Accordingly, the incentive to develop the gas turbine for locomotives is less than in many other applications, particularly aircraft and stationary uses.

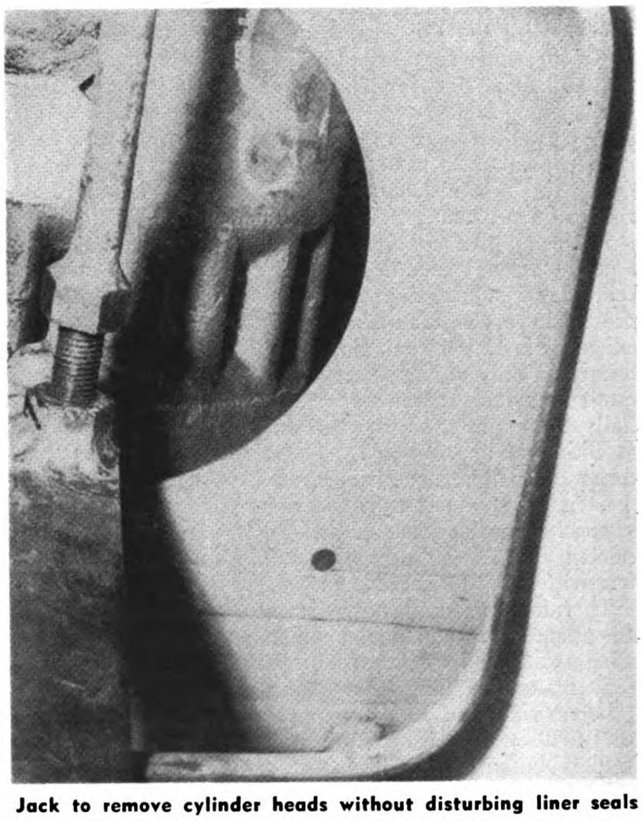
Forward Policy

It appears sensible, therefore, to adopt a forward policy as follows: (1) Let the gas turbine develop first in the application such as aircraft, power stations, and other stationary applications where it has a natural advantage, and then apply, so far as possible, this development work to the locomotive; (2) protect the current investment in diesel-electric locomotives by concentrating developments in the field of gas-turbine locomotives on a power unit which will exactly replace the existing diesel engine prime mover. If and when the gas turbine can be made to show superior advantages and economy, the power unit alone, representing only say 20 per cent of the cost of the locomotive, can then be substituted for the existing engine.

Such assurances should dispel any hesitations which may have been created in either railway or financial circles by premature and unjustified claims for the gas turbine which at this time cannot invalidate proven experience with the diesel-electric locomotives.

Heads Removed Without Disturbing Seals

A liner jack has been developed at the Spencer, N. C., shops of the Southern which removes Diesel engine heads

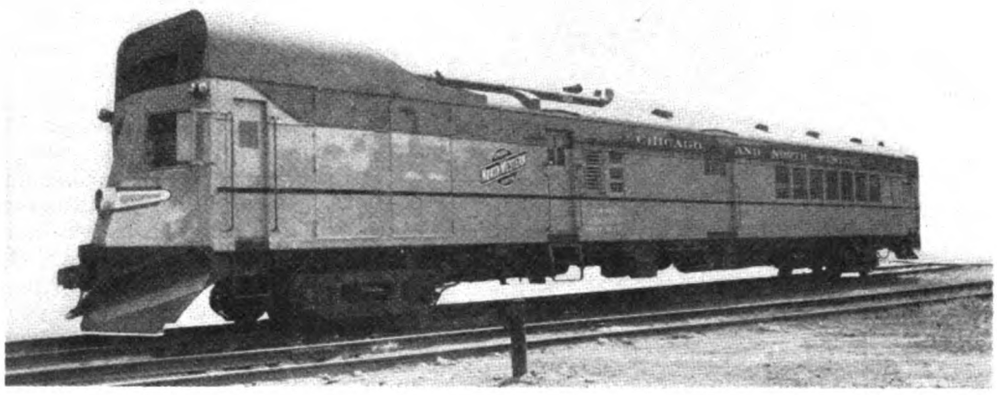


Jack to remove cylinder heads without disturbing liner seals

without disturbing the liner seals. The jack has a spring steel base $\frac{3}{8}$ in. by 2 in. and 12 in. long. One end is narrowed to $1\frac{1}{2}$ in. for insertion into the cylinder ports. A nut is welded near this end at a 75-deg. angle with the base, and into it screws a $\frac{3}{4}$-in. stud 11 in. long with 4 in. of thread.

The base rests against the inside of the ledge where the hand-hold cover normally fits. The base is supported on a 1-in. lug welded on the underneath side about $1\frac{1}{2}$ in. from the cylinder port ends. The top of the shaft fits against the top of the air box. The head is forced off by turning the shaft nut with a wrench.

C. & N. W. Dieselizes Gas-Electric Motor Car



Diesel motor car rebuilt from a gas-electric can pull one trailer and offers complete passenger train service



The passenger compartment seats 28 people comfortably

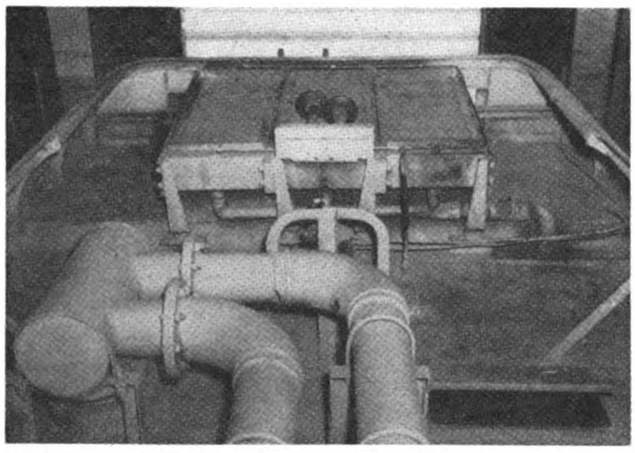
THE Chicago & North Western has completed an extremely modern-appearing comfortable Diesel-electric motor car at a cost of $36,000. Designed and built at the road's Kinzie street shops in Chicago the car offers complete passenger train service with seats for 28 passengers, a mail and a baggage compartment. The car is powered by a six-cylinder 4-cycle Sterling Diesel engine with a Buch supercharger which delivers 300 hp. to the traction motors. It is designed for normal operation with one trailer in either secondary line or commuter service. The first assignment will be on a branch line between Madison and Lancaster, Wis.

The car has a length of 83 ft. 6 in. over couplers, a width of 9 ft. 11⅜ in. over the cowling sheets, and a height of 14 ft. 5¼ in. above the rail. It has a top speed of 60 m.p.h. and a weight of 140,000 lb., with approximately 45 tons on the front truck and 25 tons on the rear truck. Four-wheel trucks are used, with the front truck only powered. Fafnir oil-lubricated roller bearings are used on all wheels of both trucks.

The car was converted from an existing gas-electric rail car which was in need of extensive repairs. The existing generator, Type DT-516-A, 450-volt, 200-kw., was repaired by the railroad and sent to the factory for mounting with the Diesel engine. The existing traction motors, Type 292A, were reconditioned and mounted on differnet trucks. New side sills and side plates were applied from the mail room front partition to the back end of the car. From this partition forward there is an entirely new underframe. The old center sills and side sills were cut at this point and all holes plug welded. The same was done with the side sills. The new sections were riveted to the old through splice plates.

A one-piece steel underframe coverplate, 11 ft. 11⅛ in. long, 9 ft. 3 in. wide and ⅜ in. thick. was applied under the entire engine compartment. Expanded metal floorboard for gangways is mounted four inches above the coverplate, giving a space that can be easily hosed out and kept clean. The engine is mounted on 14 Korfund Vibro-Isolators with shear lugs for horizontal shear and switching shocks. Over the engine compartment is a hatch 11 ft. 10⅜ in. long providing a total opening 11 ft. 6⅞ in. long which can be removed in 15 to 20 min.

The nose is fabricated of ⅛-in. steel below the windows and 12-gauge steel above the windows. The car is designed to meet all Railway Post Office requirements. Met-L-Wood partitions are used between the engine compartment and the operator's cab. Insulated metal parti-



Roof arrangement over the engine compartment on the Diesel motor car

tions separate the cab and the mail rooms, the mail and the baggage room, and the baggage room and the passenger space. Adlake breather sash is used for the front windows and standard sash for the remainder. Control is by a hydraulic throttle. New Young radiators were mounted on natural rubber in shear.

The cast steel trucks were taken from another motor car with the center plate and side bearings changed to suit the new installation. The front journals are 5½ in. by 10 in., and the rear journals 5 in. by 9 in. On the interior of the car the wash rooms were enlarged, a luggage storage compartment installed in the rear, the old smoking compartment removed, new upholstered, walk-over-type coach seats were substituted for the old bucket type, a new floor laid, the number of lights doubled, and a 426-amp.hr. battery installed, the latter charged from the exciter through a voltage regulator and a reverse current relay.

Two Hot Water Systems

A water heating system and a hot wash water system are supplied from a 150-gal. storage tank, which is also piped to provide make-up cooling water to the engine in emergency, and to furnish cold wash water and toilet flushing water.

Water for the hot wash water circuit is drawn from the 150-gal. tank to a 20-gal. storage tank through a system of check valves. In passing to the storage tank it receives its heat from the engine cooling water through a heat exchanger located in the cooling water system. The hot wash water is in a closed circuit and is recirculated by a 1/6-hp.-motor-driven pump. The pump operates on the same circuit as the exciter and therefore operates continuously except when the engine is idling. This arrangement makes hot water available at all times. Even when large quantities are drawn the chill is taken off the cold make-up water by passing through the heat exchanger.

A Baker coal-fired hot water boiler located in the baggage compartment and tended by the baggage man supplies the hot water for train heating. This water is circulated by a second pump, with 1/6 hp. motor, located in the baggage compartment. The car heating system is controlled by an aquastat set at 120 deg. on the return water temperature.

Supplies carried on the car include 375 gal. fuel oil, 65 gal. lubricating oil, 190 gal. engine cooling water and 8 cu. ft. of sand.

Altitude Performance of Electro-Motive Model 567 Engine

(Continued from page 61)

box pressure did not decline as rapidly as did the free air pressure with changes in altitude. Exhaust manifold pressure for any given throttle position remained constant at all altitudes and there was little or no visible smoke three feet above the exhaust stack until an altitude of 7,000 ft. was reached. Above this altitude the smoke became progressively darker. At the maximum altitude the smoke was a blue-gray color in all throttle positions.

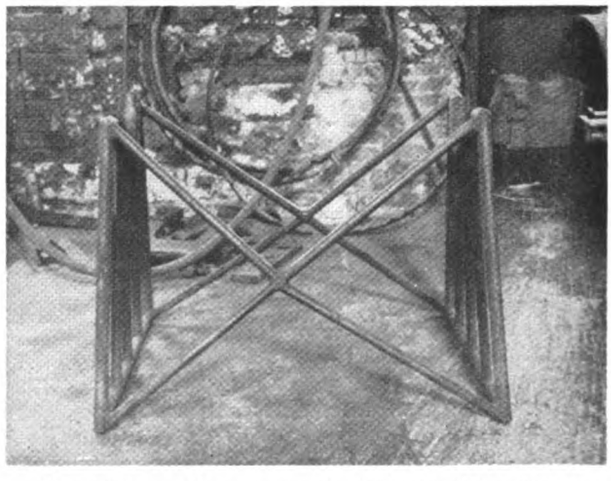
The fuel oil supplied to the engine during a weighing period was taken from the fuel weigh tank and the return fuel from the engine was cooled and then returned to the weigh tank. The temperature of this fuel remained within 5 deg. during any test period. The pounds of fuel per hour delivered to the engine remained constant for any given throtttle setting, indicating that the injectors did not change and that the power piston setting did not vary throughout the test.

This paper may be summarized by saying that the tests made in the study showed for a particular engine that (1) The power changes in relation to changes in density altitude and (2) that the heat rejection does not vary appreciably with altitude.

The data collected also made possible the construction of a chart showing the horsepower available for tractive force under various altitude and temperature conditions.

Tire Removal And Application Stand

A simple easily constructed frame has been built at the Gulf, Mobile & Ohio shops in Bloomington, Ill. for removing or applying Diesel switcher tires. The stand is made with an indention in the center for holding and securing the wheel set in place for either operation. The width of the stand is such that each wheel overhangs



Stand for applying or removing Diesel switcher tires

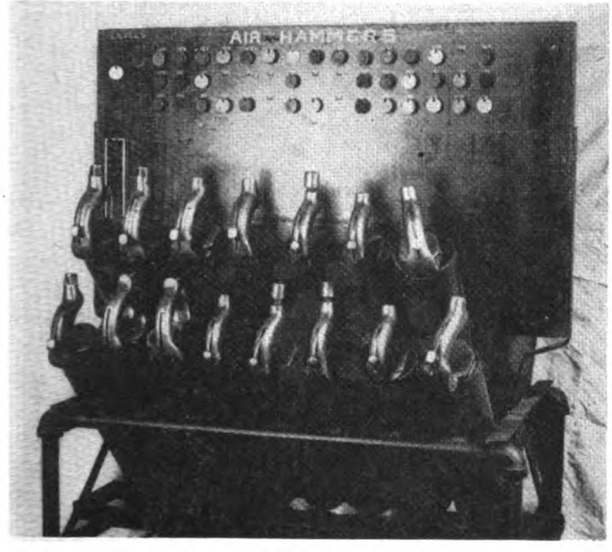
the edge sufficiently to prevent any damage to the stand from heating the tire.

The main members of the frame are of 1-in. pipe, the braces of ¾-in. pipe, and it is of all-welded construction. The width of the stand is 39 in. across the bottom and 36 in. across the top. It is 33 in. deep at the bottom and 20 in. deep at the top.

Air Gun and Drill Racks

The air gun and drill racks, illustrated, used at a western railroad shop, provide a safe and convenient place for holding these shop tools. They conserve space in the tool room and also enable tool check records to be kept with a minimum of extra steps and confusion.

The air gun rack consists of a 2½-in. angle-iron base, supporting two rows of 3½-in. and 4-in. boiler flues, 19 in. long which are welded in the rack at an angle of about 45 deg. and cut out at the top to fit the gun handles.

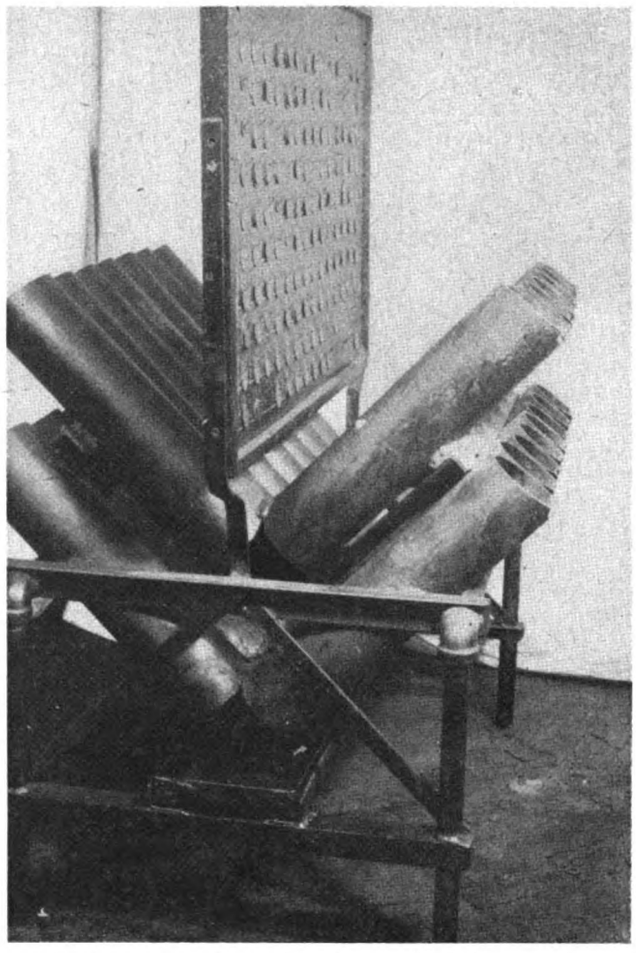


Special rack for holding pneumatic hammers or air guns

In other words, these notches make a place to receive the handle of the air guns with the throttles in a vertical position for oiling.

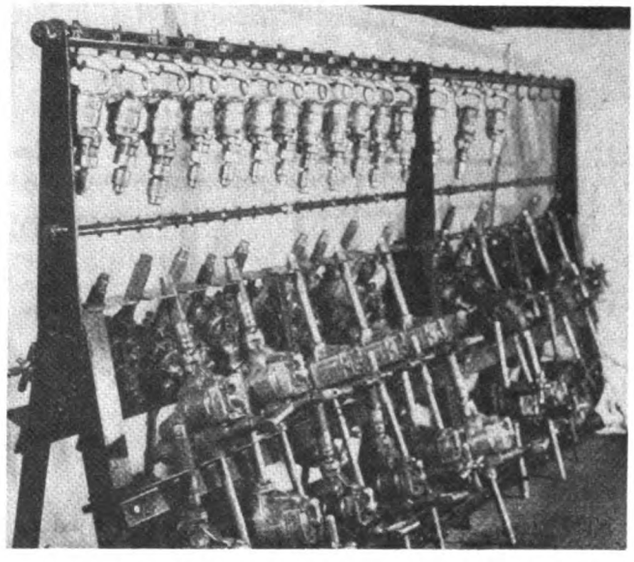
A single drip pan under the lower ends of the flue sections catches any oil which runs out of the air guns and thus prevents it from getting on the floor. A board for holding the tool checks is supported in a vertical frame at the center of the rack and saves steps by keeping the tools and checks at the same location.

The drill rack, shown in another illustration, is used in the tool room for supporting air drills when not in use, the upper part of the rack holding 23 small drills and the lower part 41 large double-handle drills. There is a small hook above each drill location on which to hang a tool check. The local shop number of each air tool is painted at the proper notch in the frame of the rack and each drill is either at its own place in the rack,

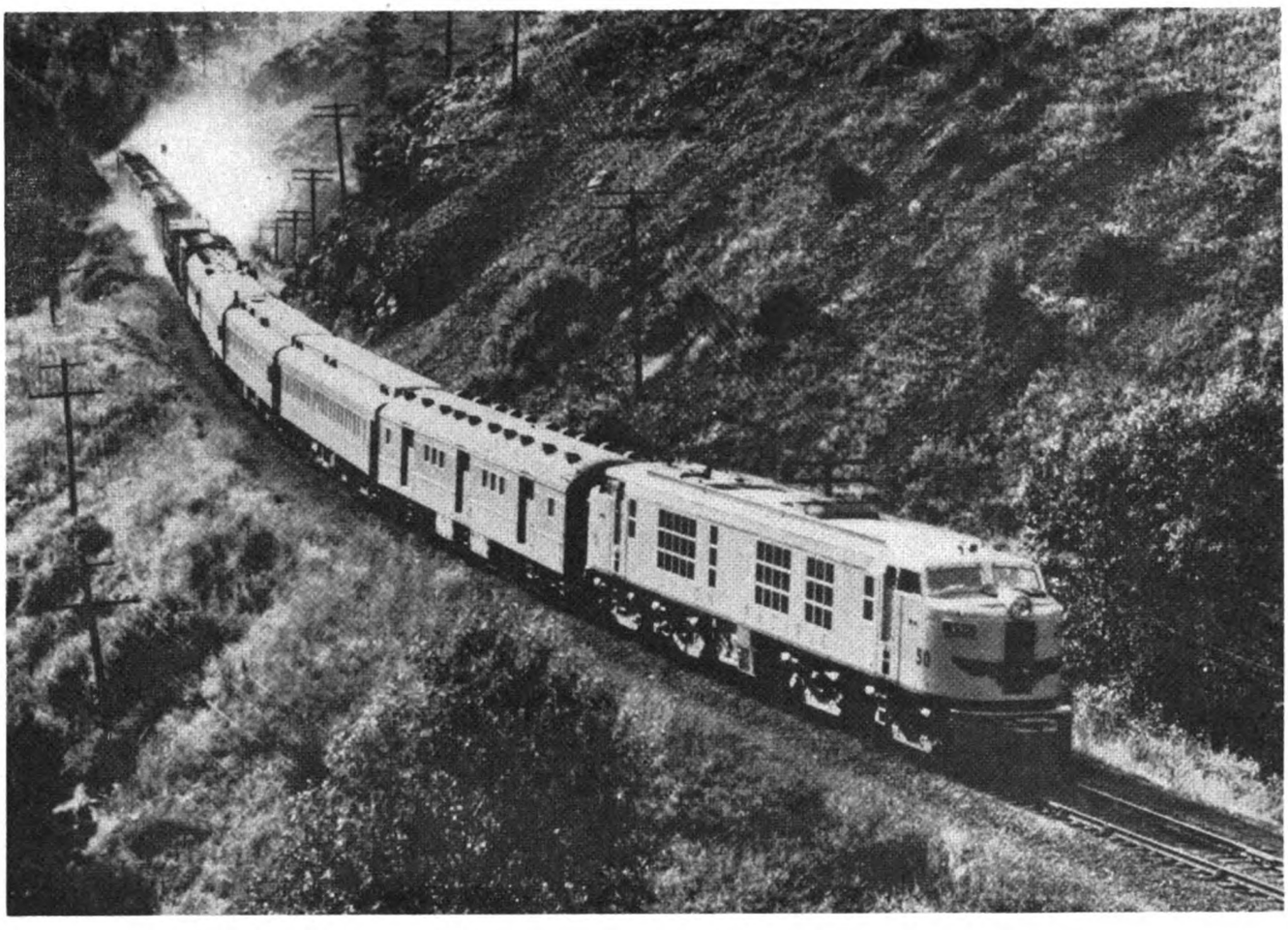


Side view showing construction of the air gun rack

or the user's tool check is there. The rack design permits drills to be easily taken out or replaced and, again, the work of the tool room attendant is made easier by keeping the tools and corresponding checks in the same location.



Tool room rack for both large and small air drills



Union Pacific Orders Ten Gas Turbine-Electric Locomotives

New units, designed for freight service with top speed of 65 m.p.h., will be built at Erie, Pa. for delivery late in 1951

THE UNION Pacific announced on December 28 that ten gas-turbine-electric locomotives have been ordered from General Electric.

The new locomotives will be similar to a 4500-hp. unit which has been undergoing tests on regular freight runs on the Union Pacific for the last year and will be assigned to regular freight service. Delivery is expected to begin in the latter part of 1951. The General Electric Company will build these Alco-GE locomotives at its plant in Erie, Pa.

Acquisition of the units by the Union Pacific is in furtherance of its policy of exploiting fully the possibilities of this modern equipment development for rail transport.

The Union Pacific locomotives will be geared for freight service and will have a top speed of 65 m.p.h. Unlike the developmental unit,* which has an operating cab at each end, the new locomotives will have a cab only at the front end.

In the latest report on performance of the developmental unit on the Union Pacific, G. W. Wilson, manager of the G-E Locomotive and Car Equipment Divisions, said it has operated nearly 80,000 miles in regular freight service and handled 285,800,000 gross ton-miles. The turbine power plant has been in operation nearly 5,000 hours.

The new locomotives will be 83 ft. 7½ in. long over knuckles, 14 ft. 3 in. high over the roof sheets and will negotiate curves of 288-ft. radius. The running gear will consist of four two-axle trucks, with each truck equipped with two traction motors. The weight will be approximately 253 tons.

* A complete description of this unit appeared in *Railway Mechanical Engineer* for July, 1949, page 363.

EDITORIALS

Not Less But More

Motive power department men who complain about diesel-electric locomotives being too complicated express an understandable and widespread attitude. They cite instances in which the failure of protective devices have caused locomotive failures, when there was nothing the matter with the locomotive. The causes of 845 failures which occurred on 545 locomotive units on three roads were listed in a paper by E. H. Holloway, diesel superintendent, Central of Georgia, presented before the Southeastern Railway Diesel Club in August, 1950. Out of the total, 404 were electrical, 224 were caused by the engine, 85 by the air system, 64 by broken pipes, 21 by axles and wheels, 17 by the fuel oil system, 14 by the lubricating oil system, and the remainder by miscellaneous causes. To most mechanical men, nearly all things electrical are inherently complicated, and when they cause 48 per cent of the failures, complaint about complications seems justifiable.

Much is constantly being done by the manufacturers to improve and simplify their locomotives, but at the same time, there are demands for better performance and these include better protection against wheel slip, slide and lock, and improved recovery after slip to insure better locomotive utilization. It seems, rather, that the variety of complications will show little decline and the number of devices is, of course, increasing with the increase in the number of locomotives.

With the additions made during the past year, there are now nearly 14,000 diesel-electric locomotive units in service, representing a total rated horsepower of more than 17,500,000. Capacities have been increased and road locomotive units rated 2,400 hp. have been placed in service. New insulating materials for traction motors have been developed, and although application has not fully proved their efficacy, they will apparently contribute to increased capacities and improved performance.

The one-piece motor coil is finding favor and may eventually dispense with the need for brazing back connections. Traction motor bearings have been improved and high-temperature greases, sealed in between motor overhauls, are establishing an excellent record.

The gas-turbine-electric locomotive continues to increase its threat to the diesel. One has been in regular road service on the Union Pacific during the year as an experimental unit, but the results of the experimentation have evidently been satisfactory since the railroad has ordered ten more locomotives.

Straight electrification was kept in the picture by 100 multiple-unit motor cars being delivered to the New York Central and by two rectifier locomotives now being built for the Pennsylvania. The m.u. cars, which are air conditioned and fluorescent-lighted, employ a traction motor on every axle. The rectifier locomotives should perform exceptionally well, and they will serve to indicate what may one day be expected of an electrification system which uses d.c. traction motors receiving power from a 60-cycle contact system.

Car electrical equipment has become highly complex, but much has been done by the builders to insure trouble-free operation. An important contribution to this is the pressure type terminals and connectors used to make most of the connections on the one to five miles of wire used in each car.

Individual, undercar diesel power plants now in service on an exhibit train are demonstrating the feasibility of using such a power supply system in which each plant feeds the trainline and each car takes from the trainline; the power plants operate in parallel. The Rock Island has demonstrated that it is practicable to operate undercar power plants in parallel with axle generators. The Pennsylvania has successfully operated a twin-unit diner with an all-electric kitchen with the power supplied by two axle-driven generators. The potentialities of heating cars from the waste heat of undercar plants are being explored, and apparatus is being developed for such applications. On-car heating systems, using oil or propane as fuel, are also in process.

The sealed-beam lamps for locomotive headlights will apparently soon cause the single-unit headlight, with its separate reflector, to become little more than a memory.

All of these things add more electrical equipment to railroad service and many mean changes in practice. Some increase complications, but others make for simplified operation. The most evident factor is change. It is human to resist it, but there is nothing so certain as change. Most of the difficulties arise from the rate at which the changes are being made.

Complete Tooling Only Part of the Job

Without doubt, one of the most effective ways of minimizing expenditures for the maintenance of any railroad equipment is proper tooling. When tools, both fixed and portable, are modern, production is increased, and when the tools are provided in sufficient number, nonproductive time is reduced to a minimum by lessening walking and standing around waiting. Because substantial gains can be attained from these two factors, modern tooling and enough of it, tooling may be considered an end in itself and thought of as the final step in attaining the ultimate goal of improved maintenance at reduced cost.

Proper tooling is certainly an important factor in the efficient operation of a shop; probably it is the most important single factor. It forms the foundation for efficient operation. Yet full advantage cannot be taken of even the

best and most complete tooling if job setup and material handling are not accorded their important places in the overall picture. In many cases the time required for the portion of the operation performed by the tool itself, such as machining an awkwardly shaped part or tightening nuts on a subassembly, requires substantially less than half of the time for the complete repair job. The handling and the setup consumes the bulk of the time.

The handling portion of the job can be reduced in several ways. One that is frequently overlooked, or at least underestimated, is bringing the job to the man. It is recognized, of course, that this has been done in numerous instances, particularly in new wheel shops, and that here are many jobs where it is completely impractical to bring the work to the man. However, where the idea is at all feasible, there appears to be good reason for giving the matter thorough study. The amount of time that can be saved for useful productive work through the partial or complete elimination of walking back and forth between jobs may be much greater than is generally realized. And with the continuing tendency toward centralization of facilities, which means shops of greater area the time that can potentially be wasted in walking seems destined to increase.

Shop Equipment Changes Too

The rapid replacement of the steam locomotive by the diesel-electric is an evolution that has had a parallel in the facilities with which motive power is serviced and maintained. Much of the heavy machinery that has characterized the railroad shop of the past has given way, in large part at least, to lighter, more expensive precision machinery designed primarily for inspecting, cleaning, testing and checking the mechanical and electrical parts which must function together in a diesel-electric unit. The buying list of the average railroad operating from a dozen to several hundred Diesel-electric units includes a lot of new names:—manufacturers of equipment such as air filter oilers and washers, lube oil heaters and circulators, chemical parts cleaning equipment, magnetic and electronic testing and inspection equipment, battery charging equipment loading resistors for testing power-plant performance, dynamic balancing machines, vapor degreasers, vacuum impregnators, distillation units, banding lathes and any number of new shop and terminal items.

Prominent in the lists of shop equipment are a variety of new wheel and axle machines, indicative not only of the greatly accelerated demand for wheels and axles but of the previously unheard-of precision of machining that is required of these parts for operation at the high speeds prevalent in both passenger and freight service today.

It is interesting to see that the demand for maximum availability of diesel-electric units for revenue service has caused shop engineers to recognize the absolute necessity of installing every facility that will contribute to the elimination of man-hours and greatly shortened shopping periods. This has brought in material- and parts-handling equipment of all kinds.

The character of shop equipment has definitely changed, but it has not crystallized. In this transition period, the millions that are being spent are indicative of the effort to keep relatively new power going. The nature of the future shop job, when the units are greater in number and require more expensive rebuilding work, may be such as to bring back into the railroad shop many of the heavy production machines formerly used for steam-locomotive repairs and now being used to build the new type of power.

NEW BOOKS

REFRIGERATION ENGINEERING. *Second Edition. By H. J. Macintire, late professor of refrigeration, University of Illinois, and F. W. Hutchinson, professor of mechanical engineering, University of California. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 610 pages, illustrated. 6 in. by 9¼ in. Price, $6.50; in Canada, $8.45.*

Professor Hutchinson has extensively revised Professor Macintire's first edition. Two chapters have been added on transient phenomena in refrigeration and a third on radiation effects. The section on reversed cycle theory has been expanded from two to eight chapters, and the chapters generally have been regrouped to form four sections on Thermodynamics of Reversed Cycles, Load Determination, Refrigeration Equipment, and Special Applications. Over 30 full-page graphical solutions give direct-reading values of the film coefficient of heat transfer for most of the commonly used refrigerants when being heated or cooled as either a subcooled liquid or a superheated vapor. The heat pump is also described from the standpoint of thermodynamic cycle analysis and from the standpoint of transient-heat-flow problems associated with energy sources and energy sinks.

HEAT INSULATION. *By Gordon B. Wilkes, professor of heat engineering, Massachusetts Institute of Technology. Published by John Wiley & Sons, Inc., 440 Fourth avenue, New York 16. 224 pages, 5½ in. by 8½ in. Cloth bound. Price, $4.*

Of particular interest in this compilation on heat insulation for engineers, architects and students is the material and data that has been brought together on reflective insulation, in which field Professor Wilkes has done much of the investigatory work. The essential concepts required for the intelligent comprehension of the subject of heat insulation are presented simply and quite completely in another chapter. Others discuss the various factors that may affect the value of the coefficient of thermal conductivity; various types of test equipment used to determine the effectiveness of heat insulation over a wide range of temperatures; types of insulating materials, moisture in insulation, and economics of insulation. There are also complete tables of conductivity values, specific heat data for heat insulators, emissivity data, etc.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

Traction Motors

(continued)

84-Q.—Describe the movement of the handle from one position to another. A.—To pass from one position to another raise the handle, move it in the desired direction until the lower latch hits the far side of the notch. This is a very slight movement. Then depress the handle and move toward the next position.

85-Q.—What happens as the position is reached? A.—The upper latch will drop into the notch, stop the movement and lock the handle.

86-Q.—In connection with the mechanical interlocks, how does the throttle interlock with the selector handle? A.—The throttle can be moved only if the selector handle is in *1, 2, 3* or *4* position.

87-Q.—When can the reverse handle be moved? A.—Only if the selector handle is in either *Off* or No. *1* position and the throttle in *Idle* position.

88-Q.—How does the selector handle interlock? A.—It can be moved to the No. *1* position from *Off* position regardless of reverse handle position. To move selector handle to the No. *2* or No. *3* or No. *4* position the reverse handle must be either in forward or reverse position.

89-Q.—What is necessary on units equipped for dynamic braking? A.—It is necessary that the reverse handle be in the forward position and the throttle in IDLE to be able to move the selector handle into the braking range.

Air Brake Equipment

90-Q.—What air brake equipment is used on all road locomotives? A.—The *24-RL* air brake.

91-Q.—Primarily, what does the cab equipment consist of? A.—The automatic brake valve, independent brake valve and Rotair valve.

92-Q.—What is the rotair valve and where is it located? A.—The rotair valve is a manually operated selector valve having four positions, and is located below the engineer's instrument panel.

93-Q.—What are the four positions? A.—Freight, freight lap, passenger and passenger lap.

94-Q.—When should the handle be placed in freight (Frgt) position? A.—On trains of 51 cars or more when controlled emergency is desired.

95-Q.—How does the controlled emergency affect the action of the locomotive brakes? A.—It causes 40 to 60 seconds delayed action of the locomotive brakes.

96-Q.—When is the handle placed in Frgt. Lap? A.—On trailing *A* units in which position the independent brake valve is cut out in freight service.

97-Q.—When should the handle be placed in Pass position? A.—On trains of 50 cars or less, when the controlled emergency feature is operative.

98-Q.—When is the position Pass Lap used? A.—On trailing *A* units in passenger service.

99-Q.—Name several cocks which are important. A.—First service cock, selector cock, brake pipe cut-out cock and safety control cut-out cock.

100-Q.—Describe the function, location and handle positions of the first service cock. A.—As the name implies, it is for cutting in or cutting out the first service operation of the brake valve. It is located on the back side of the automatic brake valve. When the handle is towards the engineer, it is cut in.

101-Q.—Where is the selector cock located and what are its positions? A.—It is located on the rotary valve seat portion and has two positions—*MR*, main reservoir (handle away from the engineer) and *FV*, feed valve (handle towards the engineer).

102-Q.—What is the connection in MR position? A.—With the handle on *MR* and the handle of the automatic brake valve in release position, main reservoir air flows to the brake pipe unaffected by the regulating portion of the feed valve and overcharging is possible.

103-Q.—What is the operation in FV position? A.—When the handle is moved to *FV* position and the automatic brake valve in release or running position, the brake pipe is connected to the control pipe and feed valve pressure will be maintained in the brake pipe.

104-Q.—Give the function, location and handle position of the brake pipe cut-out cock. A.—It is used for cutting the brake valve in or out. It is located on the lower portion of the automatic brake valve. When the handle is pointing away from the engineer it is cut in and in the vertical position it is cut out.

105-Q.—Give the location, function and handle position of the safety control cut-out cock. A.—The safety control cut-out cock on the service application portion is used to cut in or out all safety devices (dead man control, locomotive overspeed and train control, if used). With the handle down, all safety devices are cut in.

106-Q.—Describe the location and function of the control valve. A.—It is located in the nose of the *A* units and in the forward end of the *B* units, and when actuated by the brake valve, operates to charge, apply and release the brakes.

107-Q.—What does the control valve in the B units include? A.—The controlled emergency cock which should be positioned at *F* or *P* to correspond with the position of the rotair valve in the leading *A* unit.

108-Q.—What features are common to control valves in the A and B units? A.—Charging change-over cock, dead engine cock and graduated release cap.

109-Q.—How should the charging change-over cock be positioned? A.—At *F* or *P* to correspond with the position of the rotair valve in the leading *A* unit. When in *F*, charging of the auxiliary reservoir is at a slow rate, while in *P* the rate is much faster.

110-Q.—Describe the positions of the dead engine cock. A.—Should be in *Live* position for normal operation and in *Dead* position when the locomotive is hauled dead in the train.

111-Q.—Describe the positions of the graduated release cap. A.—Two positions, *Gra* and *Dir* for graduated release and direct release. Graduated in passenger and light freight service, and direct in heavy freight.

112-Q.—Where is the dead man pedal located, and when must it be depressed? A.—It is located on the floor in front of the engineer's seat, and must be depressed at all times, except when the locomotive is stopped, and when 30 or more pounds of brake cylinder pressure exists.

113-Q.—What takes place if the pedal is released during operation? A.—The safety control whistle will sound for two to four seconds, during which time the pedal can be depressed, preventing brake action. Otherwise, full service application of brakes will be made.

Schedule 24RL Air Brakes

SAFETY CONTROL FEATURE (*continued*)

Operation of the Service Application Portion

1007-Q.—What connection is made when the rotair valve is in freight position? A.—Passage *23*, which connects to the first suppression reservoir through pipe *23* and passages *23* and *33*, and suppression timing reservoir (if used) in FREIGHT position of the rotair valve, is connected by cavity *S* to passage *31* leading to the timing valve choke *X* and to the diaphragm chamber of the timing valve *121*.

1008-Q.—What does this provide for? A.—It permits a timed exhaust of the first suppression air from the top of the timing valve diaphragm *124* to provide for a split reduction of brake pipe pressure.

1009-Q.—Describe this operation further. A.—Air from the first suppression reservoir deflects diaphragm *124* in the brake valve which seats valve *121* and prevents the flow of first reduction reservoir air from passages *5* and *18* past valve *121* into passage *18* to atmosphere.

1010-Q.—What limits the initial brake pipe reduction? A.—Equalizing reservoir air reduces from passage *5* into *24* and the reduction limiting reservoir and limits the initial brake pipe reduction.

1011-Q.—When is the timing valve opened? A.—Timing valve *121* is opened when the air pressure in the first suppression reservoir and in the chamber on top of diaphragm *124* has reduced to about *10* lb. through timing choke *X*.

1012-Q.—What then serves to provide a full service application? A.—Combined volumes of the equalizing and reduction reservoirs then flows past the timing valve *121* into passage *18* to provide a full service application.

1013-Q.—Can the safety control application be released in Release, Running and First Service positions? A.—No.

1014-Q.—What prevents release in these positions? A.—Cavity *t* in slide valve *114* connects passage *10* from the top of piston *112* to passage *8*, leading to the exhaust valve *235*, which is open to atmosphere in these positions.

1015-Q.—What connection is made in the event that the electro-pneumatic brake valve portion is not used? A.—In this case, passage *8* leads to rotary valve *216* and the atmosphere.

1016-Q.—What position of the brake valve must be used to release a safety control application? A.—Lap position.

1017-Q.—Why does the application release in Lap position? A.—Pressure builds up in chamber *B* on top of piston *112* to build up as previously described under Charging.

Operation of Emergency Application Portion

1018-Q.—How is the safety control system charged when the emergency application portion is used? A.—It is charged with brake pipe air from chamber *B* through a choke in the emergency application piston *161* to chamber *C*, passage *10*, pipe *10*, to chamber *C* in the cut-off valve of the H-24 Relayair valve unit.

1019-Q.—What is the position of cut-off valve diaphragm, with the brakes released? A.—With brakes released and no air in chamber *D* over diaphragm *10*, the diaphragm is moved to its upward position by spring *6*.

1020-Q.—What action follows this movement? A.—Valve *17* is unseated and permits spring *19* to move lower valve *15* to its upper seated position.

1021-Q.—When this happens, how does the air flow? A.—Air from chamber *C* can then flow to chamber *A* and out passage *3* to pipe *3* and the diaphragm foot valve.

1022-Q.—Is the safety control system then charged? A.—Yes, if the rigid handle brake valve is used.

1023-Q.—What is the result if the hinged handle type is used? A.—If the diaphragm foot valve is released, diaphragm *6* will be off its seat and air can flow to pipe *3* and passage *3* in the brake valve to the chamber on top of exhaust valve *351*, which is seated when handle *370* is depressed.

1024-Q.—When does piston 161 assume release position? A.—When the safety control system and chamber *C* in the emergency application portion are charged to brake pipe pressure.

1025-Q.—How is a safety control application initiated? A.—If the foot pedal is released with the rigid handle brake valve, or both the foot pedal and brake valve handle are released with the hinged handle type.

1026-Q.—Describe action taking place with the rigid handle type. A.—Air from chamber *C* on the spring side of emergency application piston *161* is vented through passage *10*, pipe *10*, chamber *C* in the cut-off valve, chamber *A*, passage *3* and pipe *3* to the diaphragm foot valve and choked exhaust and whistle.

1027-Q.—Describe the additional flow of air if the hinged handle type is used. A.—Past diaphragm *6*, pipe *3* to the brake valve, passage *3* and past open exhaust valve *351* to the atmosphere.

1028-Q.—What insures the movement of piston 161 to application position? A.—The choke in piston *161* prevents build up of air from chamber *B* to chamber *C* as long as the foot pedal *12* and brake valve handle *370* are not held down or the brake applied sufficiently (with control pipe pressure about 30 lb.).

1029-Q.—What results from piston 161 being in application position? A.—The brake pipe supply in chamber *B* is cut off from the brake pipe chamber *A*, and chamber *A* is connected to the atmosphere to cause an emergency rate of brake pipe reduction.

1030-Q.—How does valve 173 function at this time? A.—It is moved off its seat which action vents chamber *C* through passage *8* to atmosphere when the brake valve handle is in release, running or first service positions.

Hydraulic Feed Car-Wheel Borer

Just announced is the Niles Hydraulic Feed Car Wheel Borer which is designed to rough and finish machine and chamfer the bore, face hubs of cast iron or steel car wheels, bore, face, and shoulder both sides of the hub of diesel locomotive wheels, and to machine the plate or web of wheel and outer diameter of hub for balancing purposes with a minimum of machining time and effort on the part of the operator.

The vertical round boring ram operates on a semi-automatic feed and traverse cycle control, permitting also manual control. Fine and course feeds and power traverse in both directions are available. An infinite fine feed selection within the range, with the control located in front of the operator, makes it possible to readily select the most efficient feed for a particular speed or material.

The machine, introduced by The Niles Tool Works Co., Division Baldwin-Lima-Hamilton Corp., Hamilton, Ohio, has a self-centering five jaw automatic chuck table which can be furnished with two types of chuck jaws. One type of chuck jaws permits chucking or 44 in. diameter car wheels or diesel wheels. The jaws are arranged to permit facing and shouldering diesel wheels on both sides. Another type of chuck jaws permits chucking of 48 in. diameter wheels for boring, chamfering, and facing the inside of the hub.

A drive box inserted in the rear of machine frame, completely enclosed, but ventilated, provides six speeds to the table arranged in geometrical progression. A low table speed range and a high table speed range are provided for the use of high speed steel and carbide tools and are obtained by use of either a two-speed a.c. or a two-speed d.c. drive motor having a 4 to 1 speed ratio. The drive box is driven through texrope belts. Gear change levers can be manipulated without any exertion on the part of the operator.

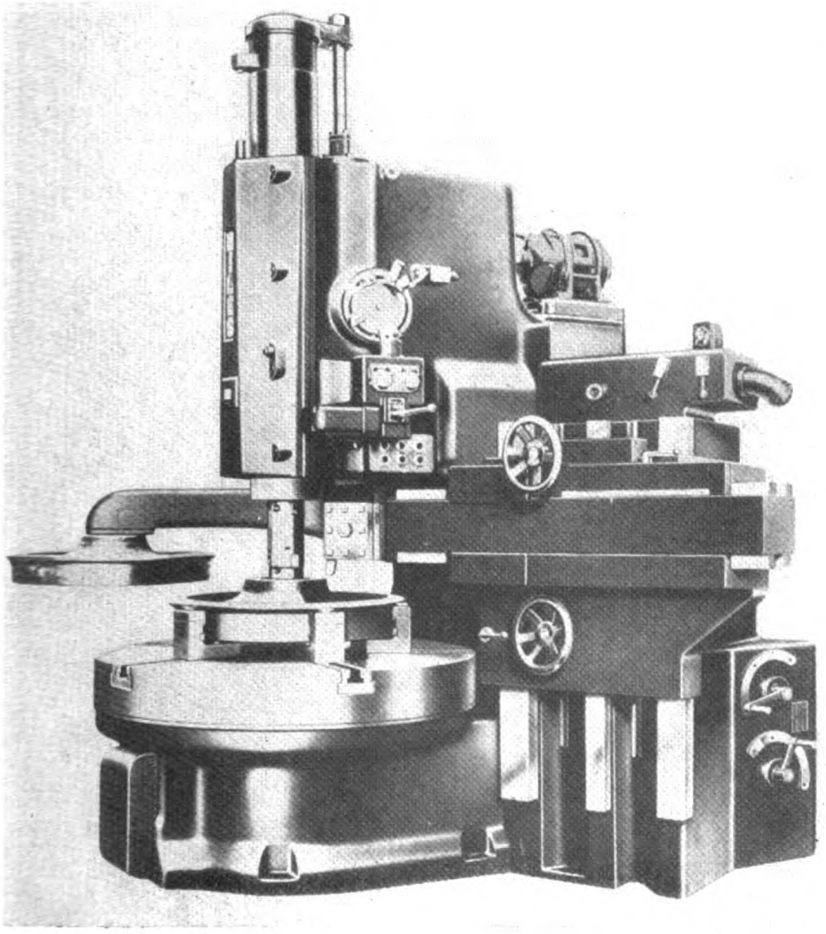
The five jaw chuck table is properly sectioned, ribbed and reinforced to resist breakage or deformation. Five radial tee slots on top are provided to receive the serrated steel chuck slides. The universal steel chuck jaws are adjustably mounted on top of these slides.

A large compression type table brake operated by a hydraulic cylinder and controlled by a solenoid valve is provided. Its function is to brake the coasting of the table after the main drive motor is deenergized, thus decreasing the floor to floor time for each wheel.

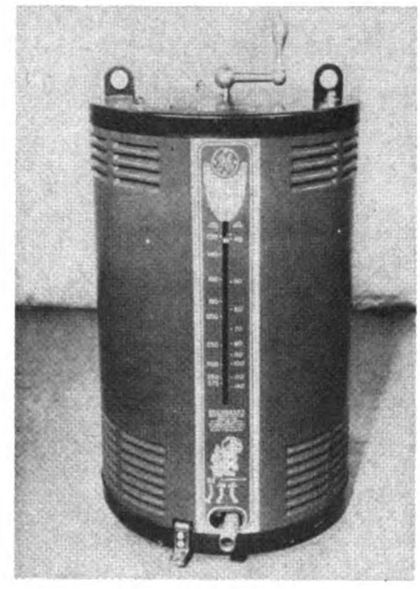
The drive box is a separate unit. Completely assembled, it is inserted into the rear of the column base, and properly supported and bolted to it.

The machine is supplied with a pump unit for vertical boring ram. It is incased in the top of the column, and is driven by a 3 hp. constant speed motor directly coupled to the pump.

The table drive is by a 20/40 hp. two-speed a.c. or a two-speed d.c. motor mounted on slide rails on the floor at the rear of the machine. The low speed table range is 7 to 30 r.p.m. and the high speed table range 30 to 125 r.p.m.



Silicone-Insulated A.C. Welder



A silicone-insulated, portable a.c. welder, equipped with automatic, hot-start control has been announced by the Welding Divisions of General Electric's Apparatus Department. Known as 6WK30J series, it is one of the first standard a.c. welder lines commercially available, incorporating silicone insulation. A high margin of safety and operating dependability is provided by this insulation since it is unaffected by high temperatures and is water repellent.

For striking the arc, the correct amount of boost is always furnished for any specific current setting. The ampere range is covered by three overlapping current ranges which permit precise current control. Thus, with hot-start control and overlapping current ranges, current is reduced to a minimum and more efficient use of electric power is accomplished.

The automatic arc starting control con-

sists of a hermetically-sealed gas-filled time-delay magnetic switch and a wound resistor which causes a surge of increased current to flow through the welding leads. This surge is present only during the critical starting period, and its degree is considerably higher at very low hard-to-start currents than at higher, easier to start current settings. Automatic reduction of boost at higher current settings avoids drawing current surges from the power line.

Coils of the welder are impregnated with Class H insulation, characterized by the use of asbestos, glass, and mica, impregnated by synthetic high temperature resisting resins known as silicones. The welder is not limited to short-time operation to avoid overheating.

The unit is 17 in. in diameter, and 35 in. in height, permitting utilization of underbench space not available to larger welding units. It weighs 325 lb., and has a current range from 40 to 375 amp., and accommodates electrodes from $\frac{3}{32}$ to $\frac{1}{4}$ in. diameter. Mounted on a running gear, it can be easily moved when required.

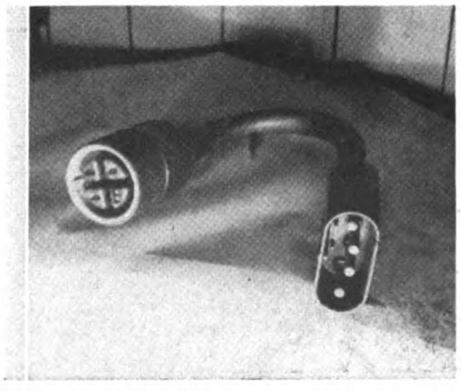
Plugs Protect Standby Power Cables

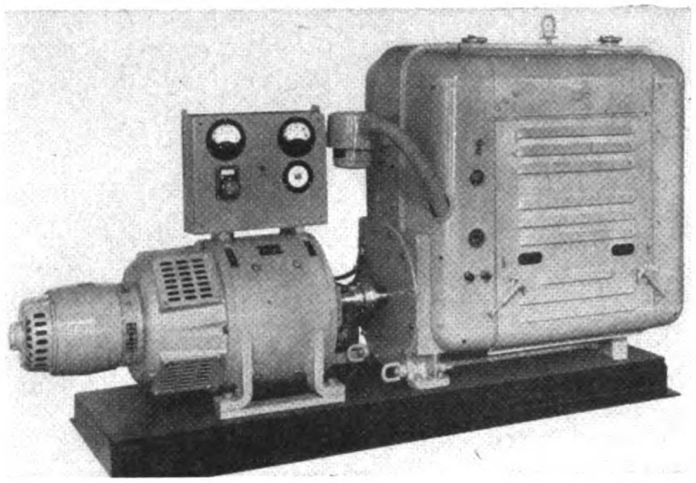
Field proven and promptly available, Joy's new railway snap-out plugs for standby battery charging and air-conditioning power lines, have been made available by the Joy Manufacturing Company, Henry W. Oliver building, Pittsburgh 22, Pa. Designed to disconnect when pull on the cable reaches 50 lb., the plugs protect equipment and personnel from injury when the train moves before proper disconnects can be made.

In action, the male snap-out in a 30-in. car jumper section pulls out of the female snap-out on end of trailing cables. When this occurs, the car relay circuit is broken through a pilot circuit (small pins) and the car's power is cut off its standby receptacle. The short jumper section remains with train for damage-free removal later and the undamaged trailing cable with its female end connector (contacts recessed in Neoprene) remains at its station. The assembly is shatter-proof, water-tight and wear-resistant.

One of the illustrations shows the female snap-out which is attached to the charging cable and the other shows the short section which stays with the car in case the car is moved before the cable is disconnected.







Stand-By Power Source

A 12½ kw., single-phase, remote-start type DAC125R motor-generator set is being produced by the Electric Specialty Co., Stamford, Conn. It is one of a line of remote, manual, or automatic start Diesel and gasoline electric power sources designed for railroad stand-by power.

The units are featured by their compact size, rugged construction, and close voltage regulation. Gasoline-powered units are available in ranges from 300 watts to 20 kw., and Diesel-powered units from 1½ to 20 kw. Generators supply d.c. and a.c. single-, two-, or 3-phase power.

Sealed-for-life bearings and drip-proof construction minimize service requirements. The engine is replaceable as a unit, and the generator armature may be removed and replaced without dismounting either the generator frame or the engine. All rotating parts are dynamically balanced before assembly and each set is test run with its own power under actual load conditions.

Diesel Engine Thermocouples

Now available are a series of Brown Diesel engine thermocouples equipped with stainless steel or carbon steel protecting tubes which are specifically designed for measuring cylinder exhaust temperatures.

These units, which are said to be extremely accurate, develop a large electromotive-force and are built to withstand severe vibration and corrosion. Although designed primarily for use on Diesel engines, the type of construction has been found ideal for many other applications.

The terminal block is molded from heat-resistant insulating material with raised characters for permanent identification of type and polarity of thermocouple. Washer head screws are provided for convenient and secure leadwire connections. This device is available from the Industrial Division, Minneapolis-Honeywell Regulator Company, Philadelphia 44, Pa.

Journal Box Lid

The illustrated journal box lid can be attached or removed quickly without the use of tools. Incorporated into the design of the lid is a keeper-pin that holds the hinge assembly under pressure during shipment and storage. When the hinge pin has been inserted, hand pressure on the lid permits the keeper-pin to be withdrawn easily. It requires no hammering or fastening to insert or secure the hinge-pin. Stops formed in the ends of the lid bearing holds the straight hinge-pin in position under spring pressure.

This device, made available by the Motor Wheel Corporation, Lansing, Mich., has been certified by A.A.R. to specification M-120-47. Both ends of the hinge-pin are supported by ¾ in. lid bearings to minimize wearing of lid holes and scoring of hinge-



pin. The unit, which is made of pressed steel, opens to 120 deg. for easy access to the journal.

Center construction permits full articula-

tion up, down, right or left, insuring a tight fit on all journal boxes. A series of press fits and shear riveting makes the articulation point oil tight. An extended housing arm eliminates all opening and closing strain from the articulated point.

The lid is made in standard models and in deep flange models which provide protection from wind currents carrying foreign matter and moisture.

Thread and Gasket Sealing Compound

Rectorseal, a product developed by the Rector Well Equipment Company, Houston 2, Tex., can be used on casing and tubing joint connections in high pressures up to 8,350 p.s.i.

The compound, designated No. 2, forms a plastic elastic mass which seals the connection and keeps it leak proof. It will not cut-out under pressures or temperatures and will not harden and freeze the connection. It is impervious to LP-gas, natural or manufactured gas, gasoline and many other commodities.

In addition to being insoluble in the materials for which it is recommended, the product is non-corrosive, adheres well to metals, lubricates as well as seals. As a gasket paste, it is self-leveling so that it does not dry in waves or ridges to prevent proper mating of flanges.

There is a compound to meet practically every thread and gasket sealing requirement. For services where this compound is not listed or recommended, special formulas are available to meet sealing requirements.

Air Operated Nut Running Tool

Two devices, known as Impactools, the size 504 for nut running up to ⅜-in. bolt size, and the size 510 for nut running up to ¾-in. bolt size are now being offered by the Ingersoll-Rand Company, New York 4.

As illustrated, both tools are of the



pistol grip type, and are balanced for ease of operation. The large, easy to grip reverse caps are grooved so the tools may be quickly reversed even with greasy hands.

In designing these tools, emphasis has been placed on muffling to lower operator fatigue and increase safety. To save time on assembly operations, both units have a high run-down speed before impacting starts. Small vane type air motors give all the speed and power needed to handle difficult nut running jobs.

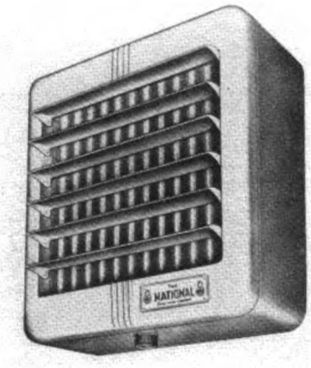
The size 510 unit is completely new. Designed for jobs where it is convenient to have one hand free to hold the work, the manufacturer states that it is the most powerful Impactool for one hand operation. It weighs 11¼ lb. and measures 10⅞ in.

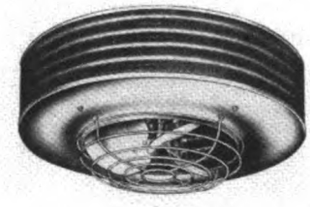
The size 504 is a completely redesigned tool, reputed to be 20 per cent more powerful and 65 per cent faster than the old model. This unit may also be used for multipurpose operation in drilling up to ⅜-in. diameter or step drilling to ¾ in., reaming up to 9/16-in. diameter, tapping up to ⅝-in. diameter, driving screws up to ⅜-in. machine, etc. It weighs 5¾ lb. and is 8-9/16 in. long.

Built-in lubricating systems in both sizes assure continuous performance and trouble free operation. Built-in air strainers keep rust, scale, dirt, small bits of hose, etc. out of the motors which prevents scoring or undue wear.

Unit Heaters

National Unit Heaters which can be used on either steam or hot water heating systems to secure a horizontal or down flow vertical delivery of warmed air, are now





being marketed by the National Radiator Co., Johnstown, Pa. There are 24 different sizes of horizontal units and 16 different sized vertical units.

At 2 lb. steam and 60 deg. F. entering air temperature, the new models are rated from 25,900 to 360,000 B.t.u. per hr. for horizontal sizes. The vertical units are available from 32,600 to 500,000 B.t.u. per hr. There are also 14 units specially designed to deliver air at low temperatures when used with high temperature steam.

Standard and heavy duty cores are available, both fabricated from seamless copper tubing. Rippled aluminum fins are bonded by a hydraulic expansion of the copper tubes. Fans are of the propeller type and motors are made specially for fan duty.

In both horizontal and down-flow units, the fan shroud is an integral part of the steel cabinet which is said to be scientifically designed to assure maximum fan performance and quiet operation. Cabinets have a baked-on crinkle finish to insure permanence and to resist corrosion.

Heavy Duty Locomotive Shutter

Shutters that are designed for severe service on all types of diesel locomotives have been developed by the Minneapolis-Honeywell Regulator Company, Industrial Division, Philadelphia 44, Pa.

The shutters, a part of Honeywell's engine temperature control system, can be installed on existing as well as all new locomotives and switchers.

Although developed for heavy duty operation, the shutters actually are lighter in weight than most shutters now being used. They can be installed on stationary power plants as well as on locomotives. The frame of the device is constructed to shed water away from the bearings so that freezing up because of excessive ice formation is avoided.

The design also creates a tight closure without the use of rubber or felt. Air leakage is eliminated at the full closed position by means of overlapping.

Diesel Engine Indicating Pyrometer

A combined indicating millivoltmeter pyrometer and rotary switch designed specifically for checking Diesel engine exhaust temperatures has been introduced by the Industrial Division, Minneapolis-Honeywell Regulator Company, Philadelphia 44, Pa.

Available in several sizes and types, these units can be furnished for surface mounting, interchangeable for bottom or back connection with conduit. In place of automatic compensation for thermocouples, the moving system is provided with a special neutralizer having a negative temperature coefficient.

Its galvanometer is pivoted on jeweled bearings. Swing of the unit is automatically retarded when the switch is in the off position, thus preventing needless wear from vibration.

Large contact type rotary switches with 6, 12 or 24 points, as specified, and with dial numbered 1 to 6 and off, 1 to 12 and off or 1 to 24 and off respectively are offered.

In place of internal connections, the instrument is complete with 20 in. of lead-wire extending from it to each switch point. Instruments with 0 to 1,000 deg. F. range may be furnished with a scale zoned in colors, with black (cold) zone 0 to 250 deg. F.; white (normal) zone 250 to 500 deg. F.; and red (danger) zone 500 to 1,000 deg. F.

NEWS

A.S.M.E. Installs New Officers

At the annual meeting of the American Society of Mechanical Engineers Railroad Division, held in New York, November 28 and 29, the following members of the Railroad Division Executive Committee were installed for 1951: Chairman, C. E. Pond, assistant to superintendent motive power, Norfolk & Western, Roanoke, Va.; K. A. Browne, research consultant, Chesapeake & Ohio, Cleveland, Ohio; C. B. Bryant, chief engineer, Technical Board, Wrought Steel Wheel Industry, Chicago; G. W. Bohannon, chief mechanical officer, Chicago & Northwestern, Chicago; E. M. Van Winkle, vice-president, American Steel Foundries, New York.

New officers appointed to the General Committee included J. S. Newton, manager, engineering department, Baldwin Locomotive Works, Eddystone, Pa.; M. C. Haber, general mechanical engineer, Union Pacific, Omaha, Neb.; C. D. Stewart, vice-president, Westinghouse Air Brake Company, Wilmerding, Pa.; B. C. Gunnell, chief mechanical engineer, Southern, Washington, D. C.; A. G. Hoppe, engineer, Research and Development, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; Alexander Ross, mechanical engineer, American Locomotive Company, Schenectady, N. Y.

J. Calvin Brown, engineer and patent attorney of Los Angeles, Calif., is the newly elected president of the Society. Regional vice-presidents for 1951 are Henry R. Kessler, manager, Republic Flow Meters Co., New York; Stephen D. Moxley, vice-president, American Cast Iron Pipe Co., Birmingham, Ala.; Dr. John T. Rettaliata, dean of engineering, Illinois Institute of Technology, Chicago; Carl J. Eckhardt (re-elected), professor of mechanical engineering and superintendent of utilities, University of Texas, Austin, Tex. Directors-at-large are Lionel J. Cucullu, assistant to chief engineer, New Orleans Public Service, Inc., New Orleans, La.; and Harold E. Martin, district manager, Babcock & Wilcox Co., New York.

4,500-Hp. Gas-Turbine Operation Report

The 4,500-hp. developmental gas-turbine electric locomotive, while built as a double-ended unit, has been operated single-ended since September 29, 1949, according to a report released on November 24 by A. H. Morey, Locomotive and Car Equipment Division, General Electric Company. Four swivel trucks make up the B-B+B-B running gear. The locomotive is geared for 69 m.p.h. and has an average weight of 506,000 lb.

The power plant is of single-shaft design and operates on the simplest gas-turbine

(Continued on page 84)

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE DECEMBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Canadian National	14 A[1]	1,500	Road freight	Gen. Motors Diesel
	14 B[1]	1,500	Road freight	Gen. Motors Diesel
	6 A[1]	1,600	Road freight	Montreal Loco. Wks.
	6 B[1]	1,600	Road freight	Montreal Loco. Wks.
Louisville & Nashville	13[2]	1,500	Road	Electro-Motive
	10[2]	1,500	Freight	Electro-Motive
	25[2]	1,200	Switching	Electro-Motive
	14[2]	1,500	General purpose	Electro-Motive
Missouri-Kansas-Texas	5	2,250	Passenger	Electro-Motive
	4	1,600	Road switch	Fairbanks, Morse
	2	1,600	Road switch	Alco-G. E.
Missouri Pacific Lines	19[3]	1,500	Freight	Alco-G. E.
	6	2,000	Passenger	Alco-G. E.
	10	1,500	Freight	Electro-Motive
	32	1,500	Road switch	Electro-Motive
	17	1,200	Switching	Electro-Motive
	20	1,200	Switching	Baldwin
Gulf Coast Lines	7	1,500	Road switch	Electro-Motive
	5	1,200	Switching	Electro-Motive
International Great Northern	6	1,500	Road switch	Electro-Motive
	2	1,500	Road switch	Baldwin
Pacific Great Eastern	6[4]	1,600		Montreal Loco. Wks.

DIESEL-ELECTRIC LOCOMOTIVE INQUIRIES

Central of New Jersey	14	1,600	Transfer	
	1	1,000	Road switch	
	16	1,200	Yard switch	

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Atlantic Coast Line	18	Dump	Magor Car
Bessemer & Lake Erie	500[5]	90-ton hopper	Pullman-Standard
Central of Georgia	300	50-ton box	Pullman-Standard
	200	50-ton gondola	Pullman-Standard
	25	70-ton covered hopper	American Car & Fdry.
Chicago & North Western	7[6]	70-ton covered hopper	Pullman-Standard
Chicago, Indianapolis & Louisville	50	50-ton flat	Greenville Steel Car
Chicago, Milwaukee, St. Paul & Pacific	250[7]	Covered hopper	Company shops
	50[7]	Caboose	Company shops
	30[7]	Gondola	Company shops
	42[7]	50-ton box	Pullman-Standard
Chicago, Rock Island & Pacific	500[8]	70-ton gondola	American Car & Fdry.
	2,000[8]	50-ton box	Pullman-Standard
	1,000[9]	50-ton box	American Car & Fdry.
Clinchfield	40	70-ton covered hopper	American Car & Fdry.
Columbia, Newbury & Laurens	50[9]	50-ton box	American Car & Fdry
Cuyahoga Valley	100[10]	70-ton gondola	Magor Car
Denver & Rio Grande Western	10[11]	Caboose	Company shops
Detroit, Toledo & Ironton	300[12]	50-ton auto. box	General American
	200[12]	70-ton gondola	American Car & Fdry.
Georgia	100[13]	50-ton gondola	American Car & Fdry
	50[13]	70-ton hopper	Greenville Steel Car
Great Northern	100[14]	70-ton covered hopper	American Car & Fdry
Gulf, Mobile & Ohio	700[15]	50-ton box	American Car & Fdry
	300[15]	50-ton gondola	Pullman-Standard
Illinois Central	1,000	50-ton gondola	Company shops
	9	Dump	Magor Car
Kansas City Southern	100[16]	50-ton auto	General American
Lake Terminal	150	70-ton gondola	Magor Car
	150	70-ton hopper	Magor Car
Mather Stock Car Co	100[17]	40-ton refrig	Company shops
Newburgh & South Shore	100	70-ton gondola	Magor Car
New York, Chicago & St. Louis	50[18]	70-ton covered hopper	Greenville Steel Car
	150	70-ton flat	Greenville Steel Car
New York, New Haven & Hartford	200	50-ton flat	Company shops
Norfolk Southern	5	70-ton covered hopper	American Car & Fdry.
St. Louis Southwestern	100[19]	50-ton box	Pullman-Standard
Union	500[20]	70-ton gondola	Greenville Steel Car
Seaboard Air Line	500	50-ton box	Pullman-Standard
	300	70-ton hopper	Bethlehem Steel
	300	50-ton gondola	Bethlehem Steel
	25	Caboose	Company shops
Union Tank Car Co	1,000[21]	50-ton tank	American Car & Fdry.
Wabash	50[22]	70-ton gondola	American Car & Fdry.
Youngstown & Northern	150[22]	70-ton gondola	Greenville Steel Car

FREIGHT-CAR INQUIRIES

Grand Trunk Western	500	50-ton box	

[1] For delivery early in 1951.
[2] Deliveries scheduled to begin early next May and to extend through mid-July.
[3] The authorization to purchase this equipment for the Missouri Pacific and its subsidiaries, the Gulf Coast Lines and the International Great Northern, was announced in the December issue, page 762.
[4] Delivery schedule for January and February, 1951. To cost $1,200,000.
[5] Delivery scheduled for the fourth quarter of 1951. Estimated cost, $4,250,000.
[6] Delivery scheduled for the second quarter of 1951.
[7] Caboose cars to be completed in June; the covered hoppers in October; the gondolas in November. Delivery of the box cars, which will cost approximately $222,000, is scheduled for the third quarter of 1951.
[8] For delivery during the fourth quarter of 1951.
[9] To cost approximately $300,000. Delivery scheduled for the third quarter of 1951.

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[10] To cost approximately $600,000. Delivery scheduled for July.
[11] For delivery during the first quarter of 1951.
[12] The box cars, to cost approximately $2,185,000, are scheduled for delivery during the third quarter of 1951; the gondolas, to cost about $1,146,000, scheduled for delivery during the fourth quarter.
[13] Delivery of the gondolas expected in June; the hopper cars, in October.
[14] Delivery of the gondolas, to cost approximately $479,658, is expected in June; of the hopper cars, to cost approximately $276,469, in October.
[15] Estimated cost, $660,000. Delivery scheduled for third quarter of 1951.
[16] Approximate cost, $900,000. Deliveries scheduled for June and July.
[17] Construction to begin during the first half of 1951.
[18] Deliveries scheduled for July and August.
[19] Deliveries scheduled for between June and September.
[20] To cost approximately $2,840,000. Deliveries scheduled for August and September.
[21] Delivery tentatively scheduled for the second quarter of 1951.
[22] For August delivery.
[23] To cost $900,000. Delivery scheduled for fourth quarter of 1951.

NOTES:

Atlantic Coast Line.— The A.C.L. has purchased five twin-unit dining cars from the Chesapeake & Ohio at an approximate cost of $1,150,000. Three were built by Budd and two by Pullman-Standard.

Grand Trunk Western.—The G.T.W. is planning a heavy program of equipment purchases and needed maintenance projects if anticipated 1950 net income of $3,882,393 is realized, according to Donald Gordon, chairman and president of this Canadian National subsidiary. A study, he said, has shown the advisability of acquiring 62 diesel-electric road and switching locomotives and up to 1,400 freight cars of various types. An inquiry for 500 50-ton box cars has already been sent out, as noted above. The feasibility of obtaining new passenger equipment also is under consideration, as is increased mechanization.

Missouri Pacific.—Authority to spend almost $7,000,000 during 1951 for improvements to property was granted the Missouri Pacific Lines by the United States District Court at St. Louis on November 21. Of this $4,785,000 will be allocated to the Missouri Pacific proper, $1,254,600 to the Gulf Coast Lines, and $849,710 to the International-Great Northern. Among the improvements contemplated is the elimination of a tunnel at Vineland, Mo., preparatory to operation of planetarium dome cars on the "Texas Eagle." Over $300,000 will be alloted for installation of new and improved air-brake equipment on some 1,500 freight cars, with the work to be done at company shops. The program also provides for equipping 22 locomotives and 28 cabooses with radio. More than $350,000 is allocated for equipment and improvements at the company's major car shops at Sedalia, Mo., and DeSoto, and North Little Rock, Ark. Slightly more than $150,000 is earmarked for construction of a diesel locomotive facility at Kansas City.

Pennsylvania.—The Pennsylvania will place orders for 66 new passenger-train cars to re-equip completely its New York-Washington, D. C. "Congressional" and the Washington-Boston, Mass., "Senator." Included in the order will be 32 coaches, 4 coach-lounge cars, 2 conference room cars, 16 parlor cars, 4 parlor-observation-lounge cars and 4 twin-unit dining cars.

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of August 1950	Month of August 1949	Eight months ended with August 1950	Eight months ended with August 1949
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	31,637	31,817	225,785	273,996
3-06	Total, Diesel-electric	18,842	13,632	134,198	96,359
3-07	Total, electric	881	791	6,527	6,571
3-04	Total, locomotive-miles	51,368	46,246	366,550	376,934
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,848	1,539	12,527	12,016
4-06	Empty, total	874	871	6,633	6,974
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	55,404	52,651	371,455	436,998
6-02	Total in oil-burning steam locomotive trains	14,508	13,664	98,828	119,446
6-03	Total in Diesel-electric locomotive trains	54,301	39,157	379,483	276,017
6-04	Total in electric locomotive trains	2,411	2,120	17,240	17,776
6-06	Total in all trains	126,664	107,614	867,186	850,303
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.05	1.05	1.06
10-02	Loaded freight car-miles	40.30	37.30	38.20	35.90
10-03	Empty freight car-miles	19.10	21.10	20.20	20.80
10-04	Total freight car-miles (excluding caboose)	59.40	58.40	58.40	56.70
10-05	Gross ton-miles (excluding locomotive and tender) (000)	2,764	2,606	2,645	2,541
10-06	Net ton-miles (000)	1,296	1,171	1,199	1,149
12	Net ton-miles per loaded car-mile (M-211)	32.10	31.40	31.40	32.00
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	67.90	63.80	65.40	63.30
14	Averages per train hour (M-211):				
14-01	Train miles	16.60	16.80	17.00	16.90
14-02	Gross ton-miles (excluding locomotive and tender) (000)	45,341	43,219	44,263	42,324
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	48.80	42.60	44.20	42.40
14-02	All	45.70	39.80	41.20	40.10
15	Average net ton-miles per freight car-day (000) (M-240)	998	799	845	811
17	Per cent of home cars of total freight cars on the line (M-240)	36.10	50.70	43.30	50.50

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000):				
3-05	Steam	12,754	15,369	93,367	130,130
3-06	Diesel-electric	15,698	13,532	115,184	99,553
3-07	Electric	1,650	1,634	12,807	13,379
3-04	Total	30,102	30,535	221,358	243,175
4	Passenger-train car-miles:				
4-08	Total in all locomotive-propelled trains	295,207	288,964	2,129,042	2,266,155
4-09	Total in coal-burning steam locomotive trains	66,545	79,244	478,212	682,070
4-10	Total in oil-burning steam locomotive trains	44,208	46,020	293,967	359,359
4-11	Total in Diesel-electric locomotive trains	166,745	146,182	1,219,207	1,078,609
12	Total car-miles per train-miles	9.67	9.28	9.41	9.14

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,533	1,653	11,232	14,961
1-02	Steam, oil-burning	284	249	1,907	2,256
1-03	Diesel-electric[1]	2,701	2,130	19,358	15,621
1-06	Total	4,549	4,058	32,710	33,049
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	57	84	478	763
2-02	Steam, oil-burning	15	15	105	128
2-03	Diesel-electric[1]	237	218	1,803	1,646
2-06	Total	344	353	2,657	2,818
3	Hours per yard locomotive-day:				
3-01	Steam	8.90	7.70	7.80	8.50
3-02	Diesel-electric	17.80	17.50	17.30	17.50
3-05	Serviceable	14.90	13.50	13.90	13.40
3-06	All locomotives (serviceable, unserviceable and stored)	12.70	11.00	11.70	11.30
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.71	1.83	1.80	1.90
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.72	0.76	0.77	0.77

[1] Excludes B and trailing A units.

(Continued from page 80)

cycle. There are no regenerators. Control of the power plant, as well as that of the locomotive, is essentially the same as that used on Diesel-electric locomotives.

Since the report last year the locomotive has operated 68,000 miles and has produced 242,389,000 ton-miles. The total mileage to date is 85,000, or a total of 285,389,000 ton-miles.

The locomotive has been in service between Los Angeles, Calif., and Salt Lake City, Utah; between Ogden, Utah, and Cheyenne, Wyo., and between Cheyenne and Council Bluffs, Iowa. These locations cover elevations from sea level to 8,014 ft. and ambient temperatures from 117 deg. to –8 deg. F. The service has been average freight service in this territory, except that practically no local freight trains have been handled. Tonnages have been dictated by motor ratings on long sustained grades. On short grades 4,500 tons have been handled successfully on 1.25 per cent grade and 6,500 tons on .7 per cent grade.

Availability of the unit has been almost anything, depending on how the term is defined. Considering availability as the percentage of total time in which no mechanics are working on the locomotive, the overall availability since August, 1949, has been 39.7 per cent. This figure includes major shopping periods in which design changes were made and developmental troubles were corrected. Since these shopping periods cannot be classified as heavy maintenance, the corresponding figure with them eliminated would be approximately 58 per cent. For two months availability approached 80.

Operating cost figures, after a year and a half of test, still mean relatively little. Much of the operation has been on special fuels for special test purposes. Moreover, no heavy maintenance has been done. The locomotive still has the original wheels under it, although they are approaching their first turning. Taking operating costs as compiled, adding an estimated amount for heavy maintenance, and comparing the result with average of diesel-electric locomotive operation indicates that operating costs of gas-turbine electrics may compare favorably with diesel-electrics.

From the train-handling standpoint the locomotive continues to be quite satisfactory. It has been able to start its tonnage under all the operating conditions which it has encountered. Adhesion characteristics have been good, and the power output has continued to be above original estimates.

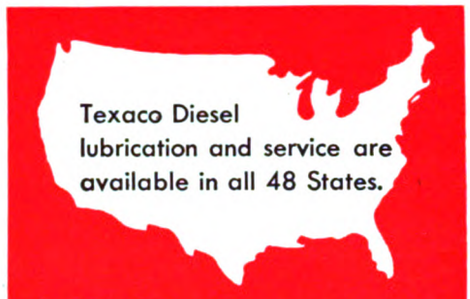
Progress has been made in correcting many of the things which were responsible for early troubles. There has been a marked improvement in combustion chamber life. Fuel handling and cleaning gave us a great deal of trouble, but is now closely approaching satisfactory operation. Electrical troubles have continued to be negligible. Power-plant starting has come to be a routine operation. The power-plant auxiliaries very rarely give trouble. Tunnel operation has continued to be quite satisfactory. The locomotive operated through the famous Aspen Tunnel

(Continued on page 86)

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(Continued from page 84)

with no difficulty, although some trouble was experienced in Hermosa with a 50-mile trailing wind. This trouble was due primarily to the fact that operating instructions were not followed.

It is still to be learned what fuels can be burned and what fuels give trouble. The fuel-heating needs considerable refinement. There are still annoyances under border-line conditions. Fuel filtering is approaching satisfactory operation, but there still remains considerable work to be done to perfect terminal testing and maintenance on the filtering equipment.

Further testing is necessary on fuels, cold weather operation, and operation in heavy snow. There also remain many refinements on pieces of equipment which require considerable road testing.

"PLUS FACTORS FOR PASSENGER-CAR HEATING."—Vapor Heating Corporation, 80 East Jackson Boulevard, Chicago 4. 58-page paper-covered book. Photoscript from sound film strip presented for the first time at Chicago on December 15. Illustrates and describes the requirements of a railroad passenger-car heating system; the Vapor approach employed to meet these requirements; the simple basic Vapor systems that may be used, and the Vapor systems of zoning that provide temperature control in various locations of the car. Suggests a plan for modernizing older passenger cars; describes a new development in room car heating; and shows some innovations that add extra comfort factors and refinement of control to a passenger-car heating system.

SUPPLY TRADE NOTES

BALDWIN-LIMA-HAMILTON CORPORATION. —*Marvin W. Smith* continues as president, and *George A. Rentschler* as chairman of the Baldwin-Lima-Hamilton Corporation, the merger plans for which were announced in the December issue. Mr. Rentschler has been chairman of Lima-



Marvin W. Smith

Hamilton's executive committee. *Charles E. Brinley* has resigned as chairman of the Baldwin board, but will continue as a director. *John E. Dixon*, chairman of the board of directors of the former Lima-Hamilton Corporation, has retired. *George H. Lynn* has been appointed general sales manager of the Hamilton Division of the Baldwin-Lima-Hamilton Corporation at Hamilton, Ohio. Mr. Lynn will be in charge of sales of machine tools, can machinery, diesel engines, and special equipment.

Mr. Lynn was in the sales department of the Westinghouse Electric Corporation from 1933 to 1939. He next became eastern representative in the sales department, lathe division, of the Axelson Manufacturing Company of Los Angeles, Cal. He was special assistant to the president of the Axelson Company prior to becoming western district manager in 1947 for the Niles Tool Works Division and the Hooven, Owens, Rentschler Division of the Lima-Hamilton Corporation at Chicago.

The item regarding the merger plans on page 762 of the December issue was incomplete. The last sentences should read:

"Pursuant to this reorganization plan, Baldwin is transferring to the newly organized Baldwin Securities Corporation its stock in the Midvale Company and in General Steel Castings Corporation and the cash derived by Baldwin from the sale earlier this year (1950) of its stock in Flannery Bolt Company, in exchange for which Baldwin is receiving all of the shares of Baldwin Securities Corporation stock. The Baldwin directors have declared a dividend to Baldwin stockholders of record November 29, 1950, in shares of the Baldwin Securities Corporation on the basis of one share of Securities Corporation stock for each share of Baldwin stock."

◆

FRANKLIN RAILWAY SUPPLY COMPANY.—*M. J. Donovan* has been appointed assistant to the president of the Franklin Railway Supply Company.

Mr. Donovan is a graduate in mechanical and electrical engineering of the University College and the Royal College of Science, Dublin, Ireland. He began his career in 1924 as a special apprentice with Kitson & Co., locomotive builders of Leeds, England. He came to America in 1926 and joined the engineering department of the Baldwin Locomotive Works, Philadelphia, Pa. He then became associated, successively with the Erie as leading locomotive draftsman, and the Chesapeake & Ohio as chief draftsman, locomotives. From 1938 to 1943 he was assistant to the chief mechanical officer both of the Erie and the C. & O. as well as of the New York, Chicago & St. Louis and the Pere Marquette. In 1943 he was named mechanical engineer of the Lima Locomotive Works, which later became a division of the Lima-Hamilton Corporation. He was appointed chief engineer of Lima-Hamilton's locomotive division early in 1950.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*Thomas C. Gray*, manager of engineering production of the Pullman-Standard Car Manufacturing Company, has been appointed director of engineering.

Mr. Gray received his high-school education in Ozark, Mo., and at San Bernardino, Calif. He obtained his B.S. degree in mechanical engineering from Purdue University in 1923 and his M. E. degree in 1927. In 1913 he became employed on the Atchison, Topeka & Santa Fe, and subsequently held various positions on that road. During World War I he was granted leave from the Santa Fe to serve in the U. S. Navy. In 1923 Mr. Gray became chief service engineer for the Locomotive Appliance Company, Toledo, Ohio, and later the same year joined the Missouri-Kansas-Texas as mechanical assistant to

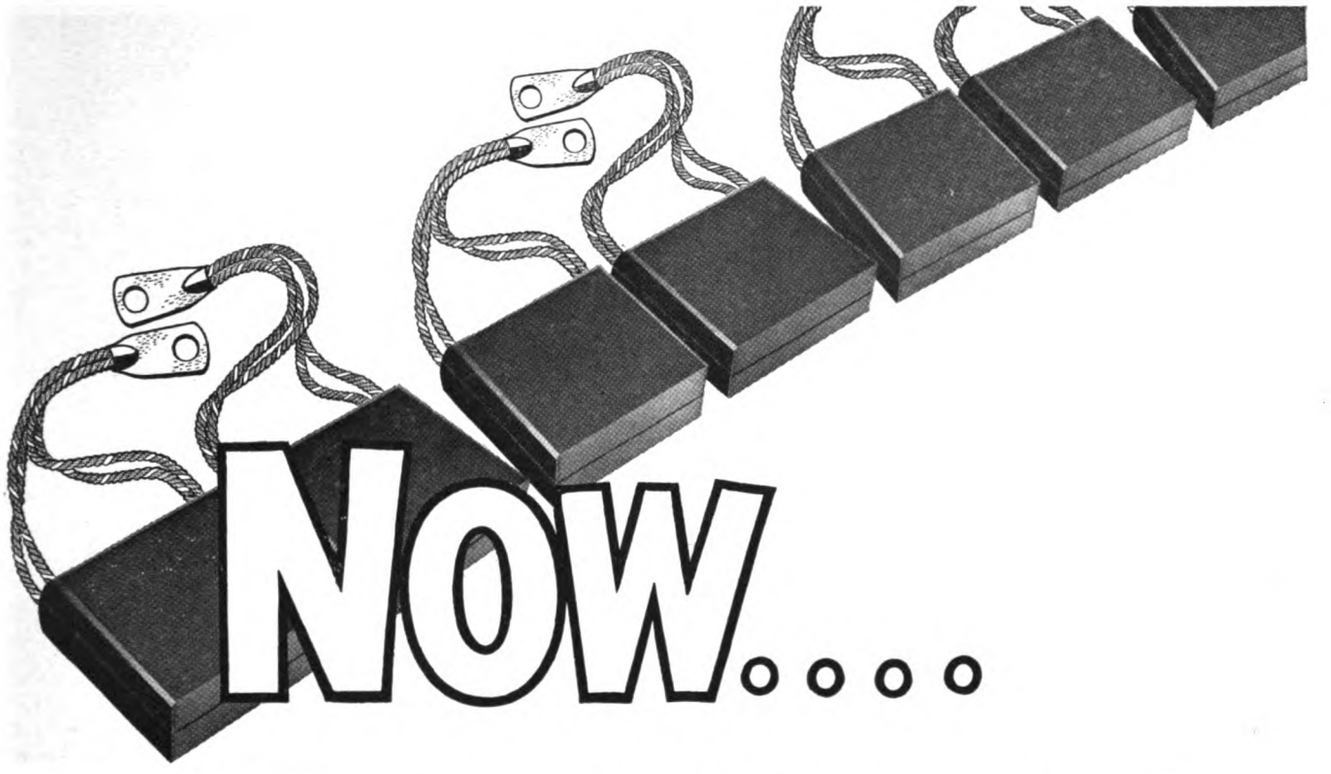


Thomas C. Gray

vice-president at Dallas, Tex. He was next appointed supervisor of apprentices on the Katy. In 1928 he joined the Barco Manufacturing Company, Chicago, as chief engineer. In 1939 he was appointed chief engineer of the Franklin Railway Supply Company, at New York. From 1942 to 1946 he served as a captain in the U. S. Navy, being stationed first at Washington, D. C., and later in Guam. In 1946 Mr. Gray became associated with the Treadwell Engineering Company, Easton, Pa., as assistant to president, and in 1948 joined the American Engineering Company, New York, as manager. Mr. Gray has been associated with Pullman-Standard since 1949, when he became manager of engineering production.

◆

CANADIAN RAILROAD SERVICE COMPANY. —*H. V. Gigandet*, vice-president of the Canadian Railroad Service Company, Ltd., has requested a leave of absence because of



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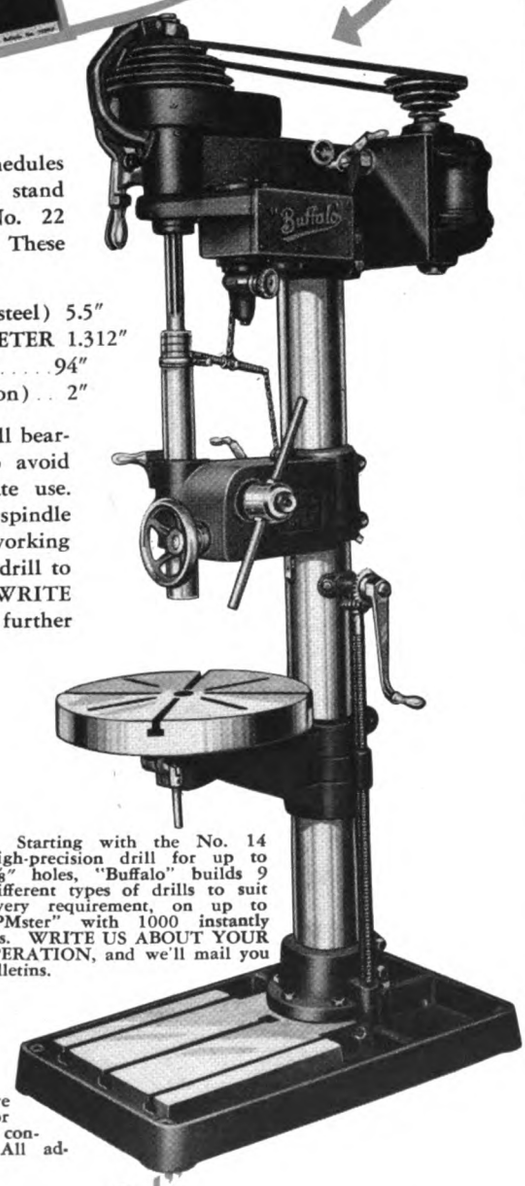
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Spindle runs smoothly on ball bearings and is held tightly to avoid deflection—for long, accurate use. Maximum space between spindle nose and the 19.50″ O.D. working table is 27½″, and you can drill to the center of a 22″ circle. WRITE FOR BULLETIN 2989-F for further facts on these drills.



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Starting with the No. 14 high-precision drill for up to ⅜″ holes, "Buffalo" builds 9 different types of drills to suit every requirement, on up to the big "RPMster" with 1000 instantly changed speeds. WRITE US ABOUT YOUR TYPE OF OPERATION, and we'll mail you applicable bulletins.

BUFFALO NO. 22 DRILL

— available in round column or pedestal types; sensitive or power feed; single or multiple spindle. All controls easily reached. All adjustments by crank.

"Buffalo"
BUFFALO FORGE COMPANY
174 Mortimer St. Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



J. V. Condon

ill health. Mr. Gigandet contemplates retirement under the company's retirement plan some time next spring. *J. V. Condon,* who has recently been appointed assistant to vice-president, will carry on in Mr. Gigandet's absence.

◆

STANDARD RAILWAY EQUIPMENT COMPANY.—*J. E. Vaughn* has been appointed vice-president in charge of all sales of the Standard Railway Equipment Manufacturing Company and its subsidiaries, with direct supervision over all sales offices. Mr. Vaughn's headquarters will be in Chicago.

◆

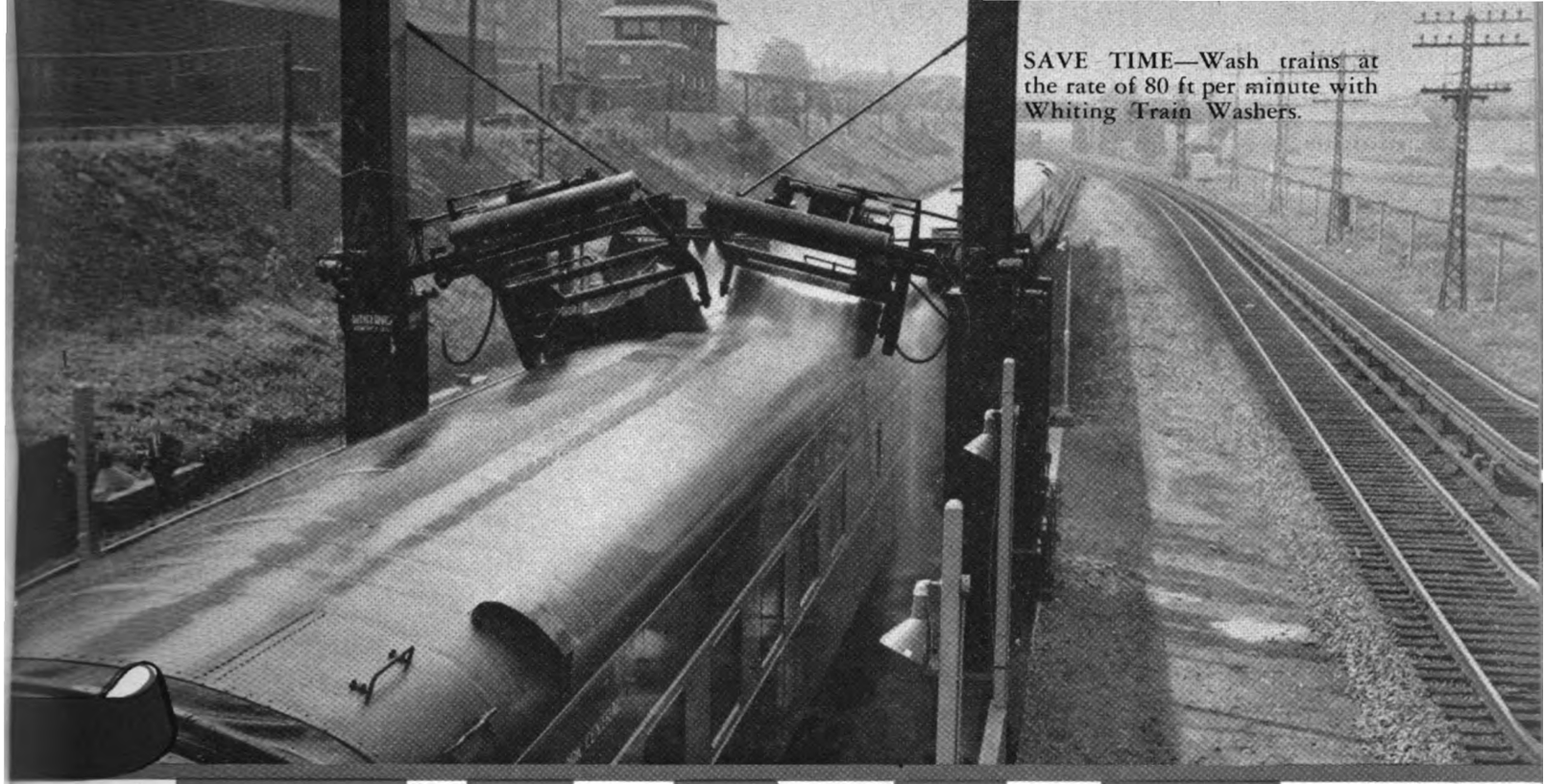
AMERICAN LOCOMOTIVE COMPANY.—*William A. Callison,* vice-president of the American Locomotive Company in charge of western regional sales, has been assigned charge of eastern regional sales, with headquarters at New York, and *William F. Lewis,* district sales manager at St. Louis, Mo., has been appointed also a vice-president of the company, and assigned charge of western regional sales, with headquarters at Chicago. *Stephen G. Harwood,* formerly district sales manager at New York, has been appointed sales manager at the Montreal Locomotive Works, Alco's Canadian affiliate.

Mr. Callison has been associated with American Locomotive since since 1929, when he completed a special apprenticeship course at the company's Schenectady, N. Y., plant. Two years later he became a

(Continued on page 92)



W. A. Callison



SAVE TIME—Wash trains at the rate of 80 ft per minute with Whiting Train Washers.

TIME

···IN OVER 1,000 SHOP APPLICATIONS



SAVE TIME with Whiting Monorail Systems. For light material handling.
SAVE TIME with Whiting Electric Traveling Cranes. For heavy handling.



Understanding—and solving your maintenance and service problems—that is Whiting's business. From the days of the "highball" to the streamlined era—railroads everywhere have profited from Whiting's "know-how."

Whether your terminal is large or small, here is equipment engineered to your needs. It simplifies heavy handling. It keeps shop operations on schedule. It reduces lay-up losses. IT SAVES TIME.

Let us work with you on your next shop problem.

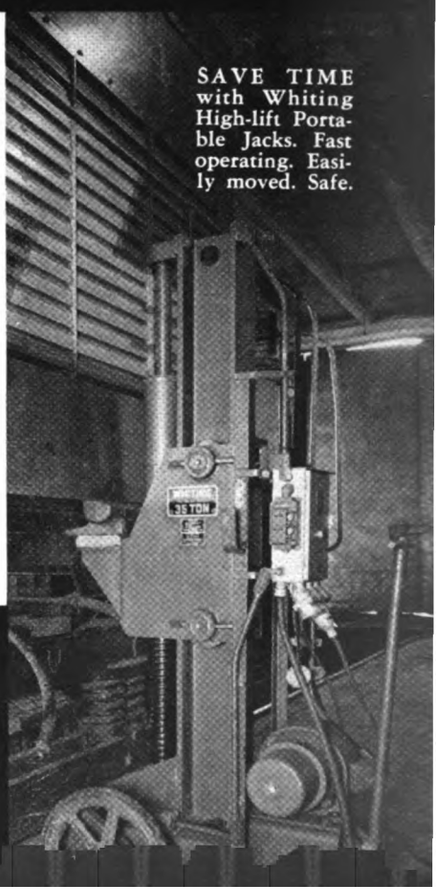
WHITING
CORPORATION
15609 Lathrop Avenue, Harvey, Illinois

RAILROAD MAINTENANCE EQUIPMENT

Offices in Chicago, Cleveland, Cincinnati, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Seattle, and St. Louis. Representatives in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church Street, New York 7, N. Y.

DROP TABLES • LOCOMOTIVE BODY SUPPORTS
SWING GATES • SPACER POSTS • TRANSFER TABLES
SIDE RELEASE TABLES • CROSS-OVER BRIDGES
PORTABLE JACKS • LOCOMOTIVE HOISTS
ELECTRIC TRAVELING CRANES • CAR PULLERS
LOCOMOTIVE SPOTTERS • DIESEL DOLLIES
TRACKMOBILE • MONORAIL SYSTEMS
TRAIN WASHERS

SAVE TIME with Whiting High-lift Portable Jacks. Fast operating. Easily moved. Safe.



Make it a One Man Job with SUPER MAGNUSOL



SAVE... $10-$12 Every Time You Clean An Engine!

You no longer need elbow grease to clean oil, grease and road dirt from the surface of a diesel engine.

One man sprays a mixture of one part Super Magnusol to six parts safety solvent on all surfaces of the engine to be cleaned, starting at the top and working down and along to the other end. By the time he has sprayed all surfaces, the dirt and oil at the starting point have been loosened. To finish the cleaning job, he goes back to where he started, and flushes the surfaces with plain water at tap temperature, following the same routine as he did when spraying. The engine will be as clean as a whistle. So will the floor, which is flushed off last. No hand work at all.

Super Magnusol is a concentrate, always mixed with safety solvent or kerosene to make the cleaning solution. It's non-toxic, non-flammable and harmless to paint and all engine surfaces. It cleans by penetrating and loosening dirt deposits and carrying them off in the emulsion it forms with the flushing water.

A demonstration is the quickest way to find out what a job Super Magnusol does . . . and the quickest path toward worthwhile economy in engine cleaning. Tell us when to send a representative with a demonstration kit.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

(Continued from page 88)

sales representative at Chicago; in 1941, district sales manager, and in January, 1947, vice-president.

Mr. Lewis joined the Chicago sales office of American Locomotive in 1934 and



W. F. Lewis

was transferred to the St. Louis sales office in 1937. He was appointed district sales manager in January, 1946.

Mr. Harwood became associated with American Locomotive at the Chicago sales



S. G. Harwood

office in 1936. In 1940 he was named district sales manager at San Francisco and in 1947 was transferred to New York.

◆

PRESSED STEEL CAR COMPANY.—*Fred M. Garland* has been appointed assistant to the president and general traffic manager of the Pressed Steel Car Company. Mr. Garland will be actively engaged in the company's laminated structures program, the first development of which was its lightweight "Unicel" freight car.

◆

UNITED STATES STEEL COMPANY.—The United States Steel Corporation of Delaware, the Carnegie-Illinois Steel Corporation, the H. C. Frick Coke Company, and the United States Coal & Coke Co., four wholly owned subsidiaries of the United States Steel Corporation, have been brought together into a single operating company. According to Irving S. Olds, chairman of the board, has announced, this single company will also be a wholly owned subsidiary of the corporation, known as



Gould "Z" Plate Batteries discharge at high rate longer, give fast, sure starts. Engines are always available.



Gould's periodic inspection service and technical assistance help keep engines available— enable diesels to meet schedules.



Lead bushings built into the cover are welded to terminal posts, making acid-tight post seals. Covers remain dry. Less cleaning, less corrosion.



Your Road Runs Like Clockwork with

GOULD-EQUIPPED DIESELS!

The extra reserve power of Gould "Z" Plate Batteries gives fast, breakaway torque and continued operation in *any* weather.

96% of the entire working surface of Gould's new "Z" Plate is *regenerative* power-producing material. The grid itself is 66% more resistant. Grid porosity is reduced 85%! GOULD BATTERIES with new "Z" Plates *are* America's Finest Diesel Starting Batteries!



Only Gould has the "Z" Plate that enables Gould Batteries to operate at full capacity more months and stay new longer.

GOULD

STORAGE BATTERIES

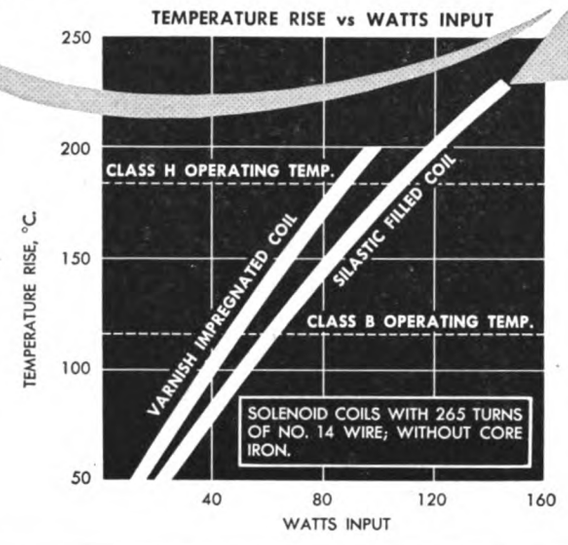
GOULD-NATIONAL BATTERIES, INC.*

TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

*Formerly Gould Storage Battery Corporation

SILASTIC* the resilient dielectric, stable from -60° to +200°C.



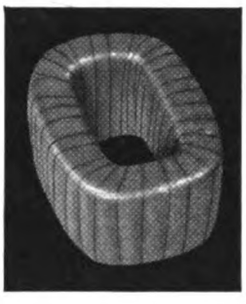
dissipates heat much faster than conventional insulating materials

Here's an insulating material that gives you all of the advantages of a rubberlike dielectric *at Class H temperatures*, plus extreme low temperature flexibility, plus about twice the thermal conductivity of conventional resinous or rubbery dielectrics! In a solenoid coil, for example (see graph above), Silastic gives 15% more capacity than resinous silicone insulation at 180°C. That's due to increased thermal conductivity alone.

Thermal stability plus high heat conductivity permit the Silastic coil to operate at 166% of the maximum capacity for an identical organic resin impregnated solenoid. Performance of over 1600 Silastic insulated main and interpole field coils in diesel-electric traction motors is further proof of the extraordinary advantages of Silastic as a dielectric.

In coils of all kinds, Silastic provides resiliency and relatively constant dielectric properties at temperatures ranging from below −60° to above 200°C., maximum resistance to corona, to electrical and mechanical fatigue and to abrasion, oil and outdoor weathering.

(*T. M. Reg. U. S. Pat. Off.)



Silastic insulated solenoid has 166% of the capacity of identical Class B coil plus maximum shock, abrasion and vibration resistance over a span of 260 Centrigrade degrees from —60 to +200°C.



SEND TODAY! **For your copy of Silastic Facts No. 10 containing data on the properties, performance and applications for Silastic.**

from +500°F. SILASTIC stays Elastic to −100°F.

DOW CORNING CORPORATION, DEPT. S-1, MIDLAND, MICH.

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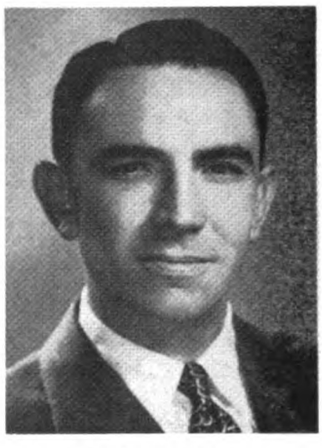
the United States Steel Company, and will have headquarters in a new office building in Pittsburgh, Pa. *Benjamin F. Fairless*, president of the United States Steel Corporation of Delaware, is president of this single company, and will continue as president of the parent company, the United States Steel Corporation. Vice-presidents of the United States Steel Company are: *Clifford F. Hood*—operations; *David F. Austin*—commercial; *Roger M. Blough*—law and secretarial; *Malcolm W. Reed*—engineering, and *George W. Rooney*—accounting. The sales offices of Carnegie-Illinois are now conducted in the name of United States Steel Company. Other subsidiaries of the United States Steel Corporation continue in business as in the past.

◆

EVANS PRODUCTS COMPANY.—*Dave Cameron* has joined the management staff of the Evans Products Company as vice-president in charge of operations at the Plymouth, Mich., plant. Mr. Cameron will, among other things, be directly responsible for all manufacturing operations involved in production of Evans' special railroad (and other transport) loading equipment.

◆

UNION CARBIDE & CARBON CORP.—*Franklin M. Finsthwait*, formerly eastern sales representative of the Oxweld Railroad Service Division, Union Carbide & Carbon Corp., has been appointed district sales



F. M. Finsthwait

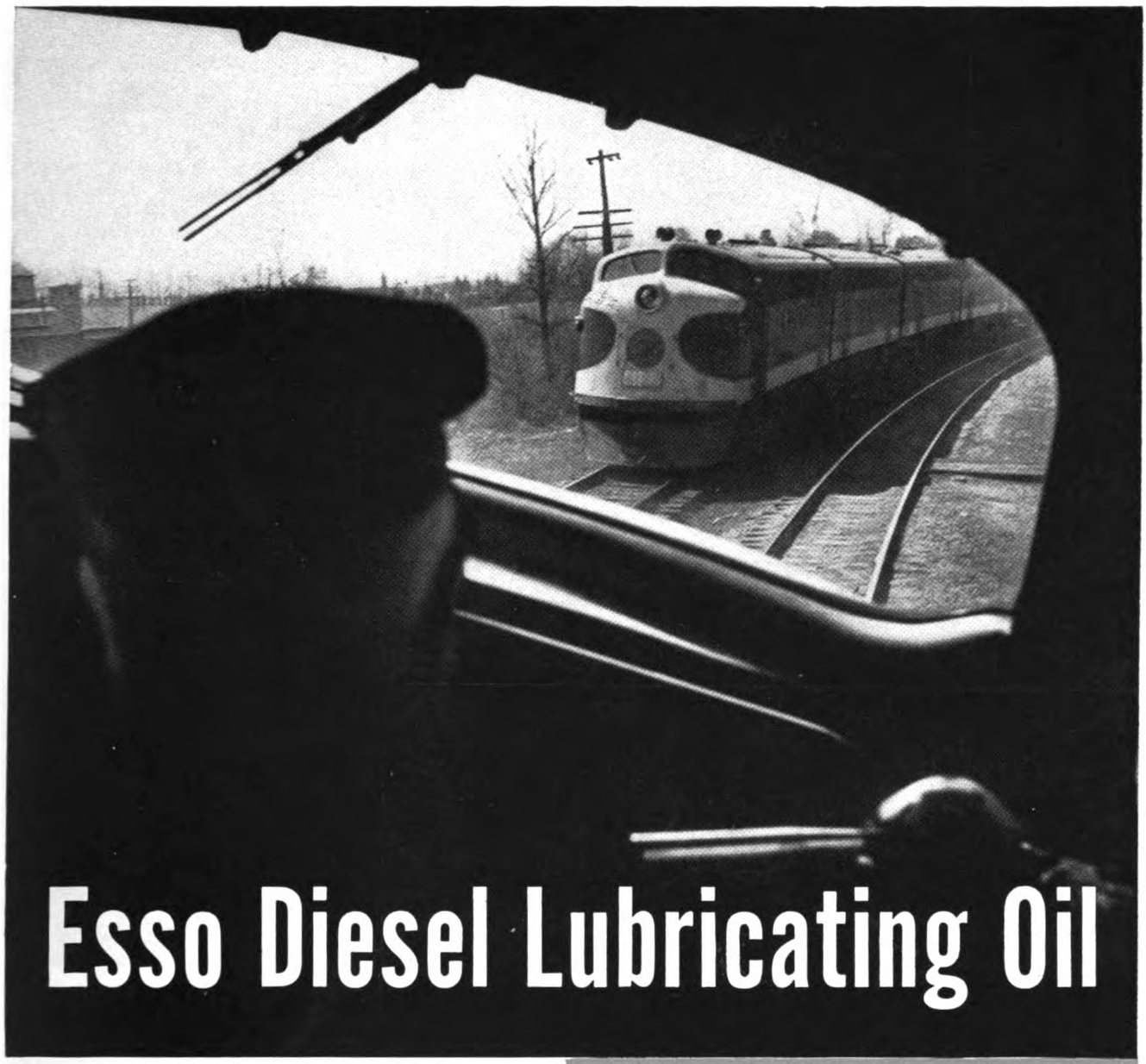
manager, with headquarters at New York.

Mr. Finsthwait began his business career with the Penn Steel Castings Corporation in 1931 and, before joining Oxweld in 1937, was associated with the Bethlehem Steel Export Corporation.

◆

EUTECTIC WELDING ALLOYS CORPORATION.—Welding engineers, researchers, metallurgists, instructors, university students, and all others qualified to present basic principles of the art and science of non-fusion welding are invited to enter the Eutectic $1,000 prize competition which closes on May 31. The subject of papers to be presented is defined as "Technological and Research Aspects, Advances and Advantages of the Use of Lower Melting (lower than parent) Filler Metals in the Non-fusion Welding Processes." Application of such processes may be by torch, furnace, induction, carbon-arc or metallic arc. Papers may specifically cover one or

"Tailor-made" for Railroad Diesels



Esso Diesel Lubricating Oil

A HIGH-QUALITY LUBE FOR REAL PROTECTION —Esso offers "tailor-made" diesel locomotive lubricating oil (Diol RD) developed through years of field testing and research by both engine designers and Esso scientists to meet needs of railroad diesels. High-quality Esso Diol RD gives dependable lubrication protection.

BACKED BY CONSTANT RESEARCH—continuing tests in the lab and on the road make sure that Diol RD keeps pace with progress and latest developments in railroad diesels.

BACKED BY CONSTANT FOLLOW-UP—on-the-job check-ups by Esso Sales Engineers watch the dependable performance of Esso Railroad Fuels and Lubricants. Be sure to call on Esso for any railroad fuel or lubricating problem.

The Sign of QUALITY — ESSO — *The Symbol of* SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

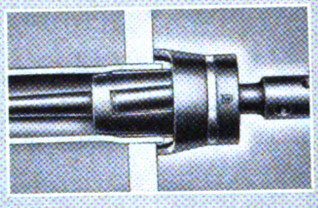
Wiedeke

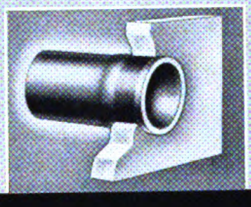
TUBE EXPANDERS NATIONALLY KNOWN FOR DEPENDABLE . . . ECONOMICAL *Service*



No. 40







IDEAL ACE TUBE EXPANDERS

The boilermakers' selection for more than a half century, for LOCOMOTIVE and general boiler work . . . guard straddles tube and bears against tube sheet, suitable for rolling new tubes and re-rolling tubes with flared or beaded ends.

MINIMUM FRICTION . . . absorbed by bronze bearing between guard and frame, resulting in much easier and faster operation.

Long rolls have generous radius on end and will not create sharp offset within the tube.

See your dealer or write today for general catalog on Wiedeke Tube Expanders and Tube Cutters.

The Gustav **Wiedeke** *Company*
DAYTON 1, OHIO

for long efficient service...

SPECIFY **JOHNSTON**

RIVET FORGES

Economical Vacuum Oil Burner; no oil valve to clog. Approved and listed as standard by U.L.



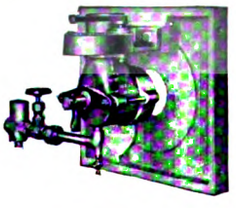


BLOWERS

Low Pressure, Direct Connected. Simple, efficient, compact, dependable.

BURNERS

Oil and Gas. "Reverse Blast". Mixes ALL the fuel with ALL the air.



FURNACES

Forging, Flue Welding, Spring, Plate and Car Type. Also Fire Lighters, Tire Heaters, Etc.

THE JOHNSTON LINE — SAFETY DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

more of the following: oxyacetylene, low melting filler; oxy-fuel gas, low melting filler; brazing and bronze welding, and hard facing and resurfacing with low melting filler. First prize is $500; second prize, $300, and third prize, $200. Rules governing the competition may be secured by writing to the Eutectic Welding Alloys Corporation, 40 Worth Street, New York 13.

A new Engineering Services Building is now being constructed at the plant of the Eutectic Welding Alloys Corporation at Flushing, L. I., N. Y.

◆

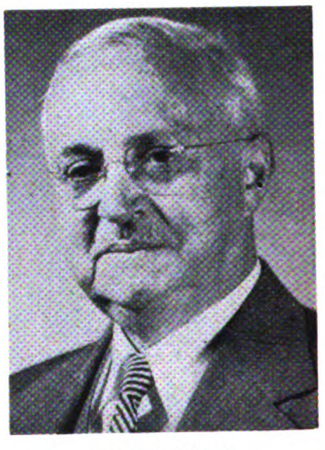
GRAYBAR ELECTRIC COMPANY.—*John T. Porter,* former manager of the Albany, N. Y., branch house of the Graybar Electric Company, has been transferred to the position of house manager at Rochester, N. Y. *Frank C. Sweeney,* former manager, telephone sales and broadcast equipment sales for the district, has been appointed manager at Albany, succeeding Mr. Porter.

◆

HULSON COMPANY.—*William K. Durbon* has been appointed vice-president of the Hulson Company, with headquarters at Chicago.

◆

ELECTRIC STORAGE BATTERY COMPANY.—*George W. Vinal* has been appointed engineering consultant and advisor to the Electric Storage Battery Company. Mr.



G. W. Vinal

Vinal recently retired as chief of the National Bureau of Standards' electrochemistry section after more than 42 years with the government.

The Electric Storage Battery Company has begun a $5,000,000 expansion program at its Crescentville (Philadelphia, Pa.) plant.

◆

AMERICAN CAR & FOUNDRY CO.—*Robert A. Harris* has been appointed chief improvement engineer in the production department of the American Car & Foundry Co., with headquarters in New York. Mr. Harris was previously assistant improvement engineer.

◆

SYMINGTON-GOULD CORPORATION.—*R. P. Brewer* has been appointed vice-president and treasurer of the Symington-Gould Corporation, with headquarters at Depew, N. Y. *H. T. Casey* has been appointed

92 hrs. of heat treatment

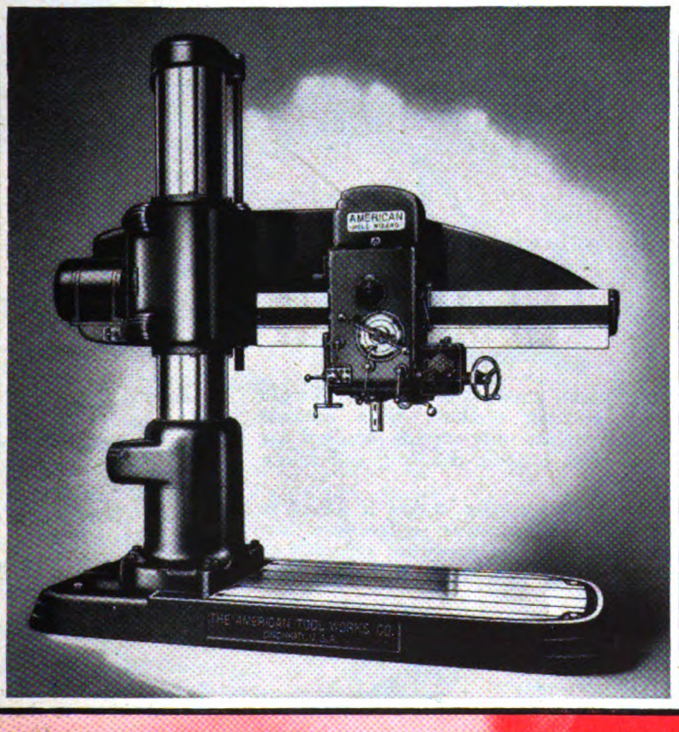
. . . required to produce the ultimate in radial drill spindles

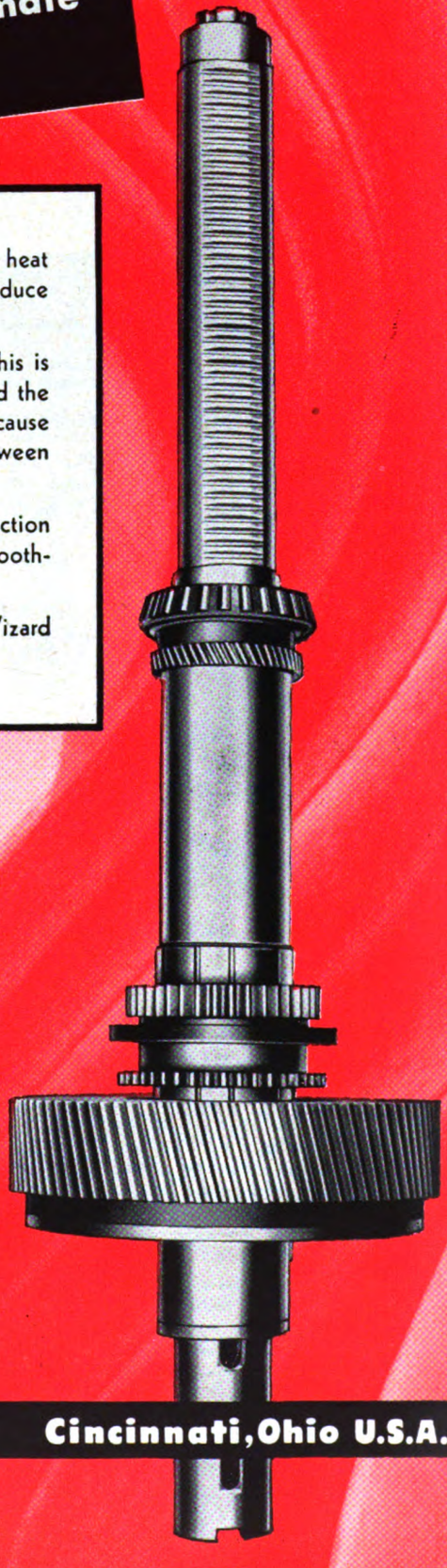
"AMERICAN" Radial Drill Spindles are made of nitralloy. 20 hours of heat treatment from rough to finish, then 72 hours of nitriding are required to produce the wear-resistant spindles used in these radials.

Both the spindles and sleeves are nitrided to 110 degrees scleroscope. This is harder than some grades of cemented carbide. The sleeve is finish honed and the spindle ground and then diamond lapped to a sliding fit in the sleeve. Because of the lack of affinity between these two hard surfaces the clearance between them may be reduced to the very minimum, which in this case is .00025".

This results in the greatest possible stability, resulting in an ideal construction especially for accurate boring operations, which demand a high degree of smoothness and rigidity of the spindle.

This is but one of the super features that make the "AMERICAN" Hole Wizard an outstanding investment.





THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

vice-president at New York, and *D. L. Townsend* has been appointed vice-president at Chicago. *M. G. DeForest* has been appointed New England manager for the corporation.

◆

AMERICAN STEEL & WIRE CO.—*Charles H. Eisenhardt*, formerly assistant manager of the electrical products sales division of American Steel & Wire Co., a subsidiary of the U. S. Steel Corporation, has been appointed manager of the division, to succeed *T. F. Peterson*, who has resigned.

CORROSITE CORPORATION.—The *Graybar Electric Company*, 420 Lexington avenue, New York, has been appointed national distributor for "Corrosite," a new plastic paint of the Corrosite Corporation, 415 Lexington avenue, New York. L. W. Taylor, manager, outside construction sales, will be in charge of all sales activities on the Corrosite line for Graybar.

◆

WHITING CORPORATION.—*A. C. Kukral* has been appointed resident sales engineer of the Whiting Corporation, at the new sub-sales office recently opened at 637 Penton building, Cleveland, Ohio. Mr. Kukral will



A. C. Kukral

be under supervision of H. E. Reynolds, district manager at Pittsburgh, Pa. *R. E. Florine*, formerly sales engineer at the New York district sales office, has been appointed district manager of the new dis-



R. E. Florine

trict sales office in Seattle, Wash., at 350 Skinner building. Mr. Florine will be responsible for sale of Whiting engineered products (cranes, foundry equipment and railroad equipment) in Washington, Oregon and Idaho, and also will handle sale of Swenson evaporators and chemical machinery.

◆

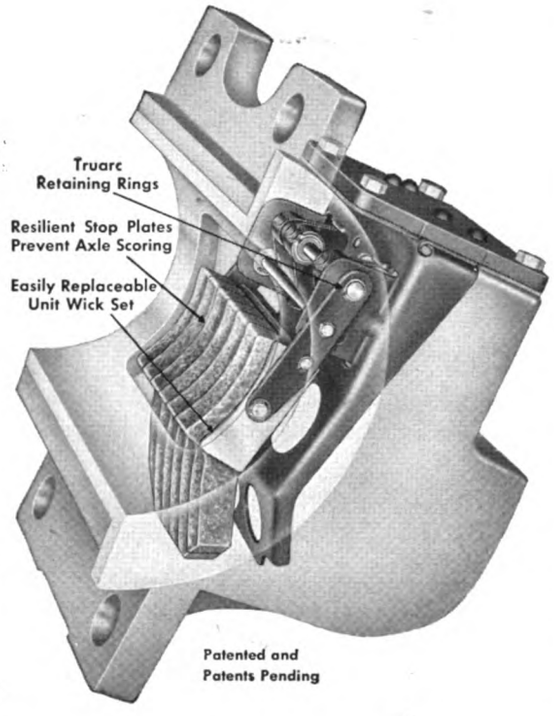
GENERAL AMERICAN-EVANS COMPANY.—The General American-Evans Company of Detroit, Mich., has made an initial mass production run of 360 of the new "D.F." box cars (described in the June, 1950, *Railway Mechanical and Electrical Engineer*, page 309). The cars are being leased to those roads with whom General American-Evans has already negotiated leasing arrangements.

◆

ALLIS-CHALMERS MANUFACTURING COMPANY.—*Dr. H. K. Ihrig* has been elected vice-president in charge of research of the Allis-Chalmers Manufacturing Company. Dr. Ihrig was previously vice-president and director of laboratories of the Globe Steel Tubes Company.

ELIMINATE HAND PACKING





STOP WASTE GRABS and STARVED BEARINGS with FELPAX Lubricators

Here's How...

FELPAX Lubricators provide BETTER LUBRICATION

- **Special Felt Wicks are held in constant contact with journal to provide full and continuous lubrication with the first turn of the axle and at high speeds.**
- **Waste grabs and starved bearings, the causes of most bearing failures, are eliminated.**

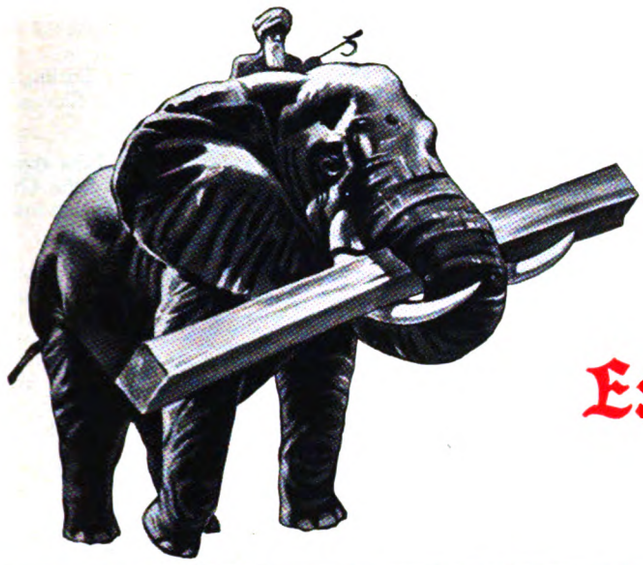
ELIMINATE THE HUMAN ELEMENT involved in the old fashioned yarn packing method. With modern FELPAX Lubricators the only service required for thousands of miles is periodic checking and filling the oil sump.

NEW, IMPROVED CONSTRUCTION makes it easier to change worn wicks. Inexpensive replacement kits contain wick set, springs and hardware necessary to completely recondition lubricator in just a few minutes!

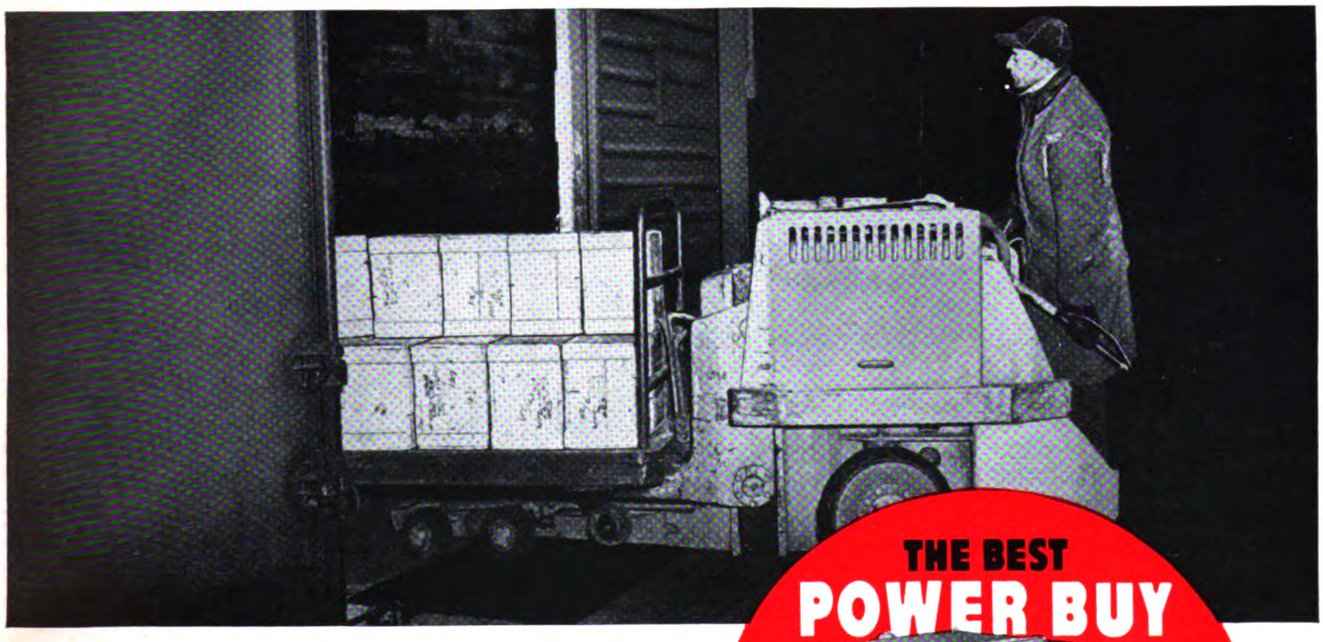
For Full Information about conversion to Modern FELPAX Lubricators see your locomotive builder or write to:

MILLER FELPAX CORPORATION
WINONA, MINNESOTA

MILLER FELPAX LUBRICATOR



IT COSTS $5.50 A DAY TO FEED AN ELEPHANT... ONLY 34 CENTS TO "FEED" AN Exide-Ironclad BATTERY





Thirty-four cents a day pays the full power cost of an Exide-Ironclad battery-powered industrial truck. Lifting, hauling and tiering all day long, it handles more tonnage than a herd of husky tuskers could move in equal time.

But low power cost is only part of the Exide story. In addition, Exide-Ironclad Batteries bring you these important benefits.

INSTANT SURGE OF POWER, plus finger-tip control, split-second handling, easy maneuvering, accurate spotting.
ROUND-THE-CLOCK PERFORMANCE—no mechanical troubles, no unscheduled down time.
UNIFORM SPEED straight through to end of shift.
LOW MAINTENANCE COSTS—seldom more than 15 cents per shift.
EXCEPTIONALLY LONG LIFE—proved on more than 100,000 heavy-duty jobs.
INHERENT SAFETY—no vibration to jar goods in transit, less worker fatigue and accident hazards.

There are Exide-Ironclad Batteries for every size and make of battery electric truck.

Write for more facts and FREE copy of Exide-Ironclad Topics. It contains latest developments in materials handling . . . shows actual case histories.

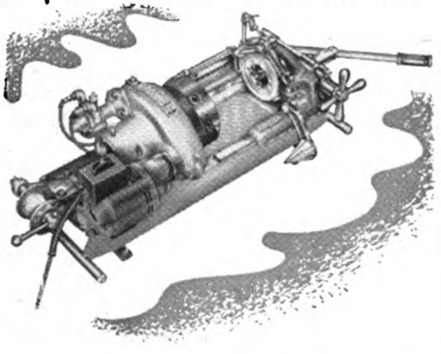
THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

"Exide-Ironclad" *Reg. Trade-mark U. S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951



the New Beaver Model-E Pipe and Bolt Machine



The new low-priced, lightweight Beaver Model "E" is a "junior edition" of the heavy-duty Beaver Model A—which has, for the past 20 years, been the recognized leader in the field of portable pipe and bolt machines.

The Model "E" uses the same dieheads—the same dies—the same patented interchangeable wheel-and-roller or knife cutoff devices—the same reamer arm and cone—as the Models A and B. This will be a great advantage to thousands of shops now equipped with the Beaver Model A or B because it eliminates the necessity of carrying in stock duplicate dies and parts—thereby preventing endless confusion and needless expense. And remember, there are 195 different kinds and sizes of dies instantly available for Models A, B or E.

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PERSONAL MENTION

General

THOMAS T. BLICKLE, mechanical assistant of the Atchison, Topeka & Santa Fe at Chicago, has been appointed mechanical superintendent, with headquarters in Los Angeles, Calif.

A. T. G. WESTBROOK, metallurgist of the Canadian National at Montreal, Que., has been appointed chief metallurgist, with system jurisdiction.

G. W. HOSSACK, supervising chemist of the Canadian National at Montreal, Que., has been appointed research chemist, with system jurisdiction.

W. P. HARTMAN, mechanical superintendent of the Coast Lines of the Atchison, Topeka & Santa Fe at Los Angeles, Calif., has been appointed assistant general manager of the mechanical department of the Santa Fe, with headquarters in Chicago.

Car Department

J. C. JOHNSON, JR., master car builder inspector at the Roanoke, Va., shops of the Norfolk & Western, has been appointed to fill the newly created position of assistant to superintendent car department.

L. F. HARRISON, foreman car department of the Atlantic Coast Line at Wilmington, N. C., has been appointed general car inspector at Jacksonville, Fla.

W. A. FARIS, road foreman of engines at the Norfolk, Va., terminal of the Norfolk & Western, has been appointed to fill the newly created position of assistant superintendent car department.

A. P. GILSDORF, general car inspector of the Norfolk & Western at Roanoke, Va., has been appointed superintendent car department at the Roanoke shops. The position of general car inspector has been abolished.

Diesel

R. F. BATCHMAN, assistant master mechanic of the New York Central, Lines Buffalo and East, at Syracuse, N. Y., has been appointed superintendent of shop (diesel) of the Boston & Albany at West Springfield, Mass.

Electrical

W. H. RICHARDSON, supervising electrician of the Seaboard Air Line at Atlanta (Howells), Ga., has had his headquarters transferred to Hamlet, N. C.

BERT L. COCHRAN has been appointed electrical foreman at the Wyoming shops of the Chesapeake & Ohio at Grand Rapids, Mich.

HUGH W. STILLINGS, assistant foreman of the Boston & Maine at Boston, Mass., has been appointed assistant general diesel foreman at the Boston Diesel Terminal.

Master Mechanics and Road Foremen

L. E. QUIRIN has been appointed master mechanic of the Chicago-Aurora-LaCrosse Divisions of the Chicago, Burlington & Quincy, with headquarters at Chicago, succeeding E. J. Cyr, retired.

J. R. VANNORTWICK has been appointed terminal master mechanic of the Chicago, Burlington & Quincy, with headquarters at Chicago.

J. E. QUINLIVAN has been appointed assistant master mechanic of the New York Central, with headquarters at Elkhart, Ind.

L. E. MCCORKLE, assistant master mechanic of the Norfolk & Western at Bluefield, W. Va., has been appointed road foreman of engines at Norfolk, Va.

G. W. MEREDITH, general foreman at the Lamberts Point, Va., shop of the Norfolk & Western, has been appointed assistant master mechanic of the Pocahontas division, with headquarters at Bluefield, W. Va.

H. H. NIEMEYER has been appointed master mechanic of the Beardstown division of the Chicago, Burlington & Quincy, with headquarters at Beardstown, Ill.

C. A. PEASE has been appointed assistant master mechanic of the New York Central, with headquarters at Toledo, Ohio.

WALLACE H. CHAPLIN, assistant general diesel foreman of the Boston & Maine at the Boston, Mass., Diesel Terminal, has been appointed assistant to superintendent of locomotive maintenance at Boston.

E. L. HYATT, assistant master mechanic of the Boston & Albany, has been appointed master mechanic, with headquarters as before at Boston, Mass. The position of assistant master mechanic has been abolished.

A. E. LANG has been appointed assistant master mechanic of the New York Central, with headquarters at Elkhart, Ind. Mr. Lang was previously general foreman at Elkhart.

Shop and Enginehouse

W. E. HARMAN, foreman at the Lynchburg, Va., shops of the Norfolk & Western, has been appointed general foreman at the Lamberts Point, Va., shop.

D. R. MAY, foreman of the Norfolk & Western at Kenova, W. Va., has been transferred to the position of foreman at Pulaski, Va.

M. P. METZGER has been appointed general foreman of the New York Central at Englewood, Ill.

O. S. HOLMES, night enginehouse foreman of the Norfolk & Western at Portsmouth, Ohio, has been appointed foreman at the Kenova, W. Va., shop.

V. L. MINNICK, foreman of the Norfolk & Western at Pulaski, Va., has been transferred to the position of foreman at the Lynchburg, Va., shop.

W. D. WALDRON has been appointed welding supervisor of the Seaboard Air Line, with headquarters at Jacksonville, Fla.

RAILWAY Mechanical and Electrical Engineer

FEBRUARY, 1951

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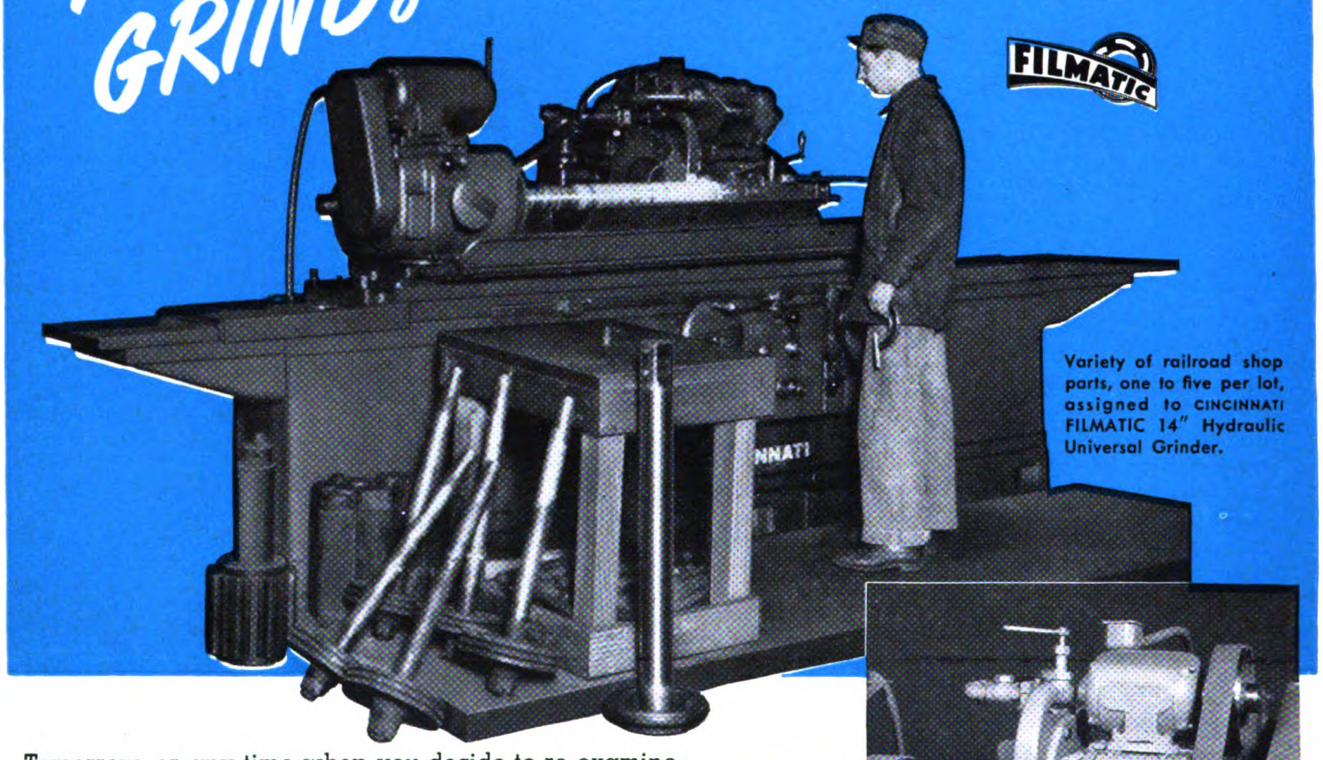
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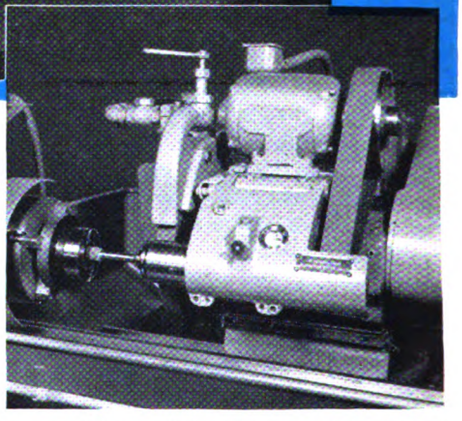
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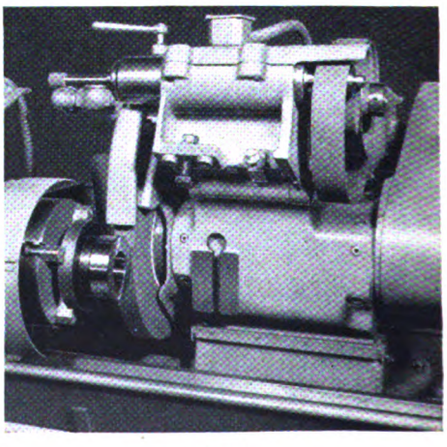
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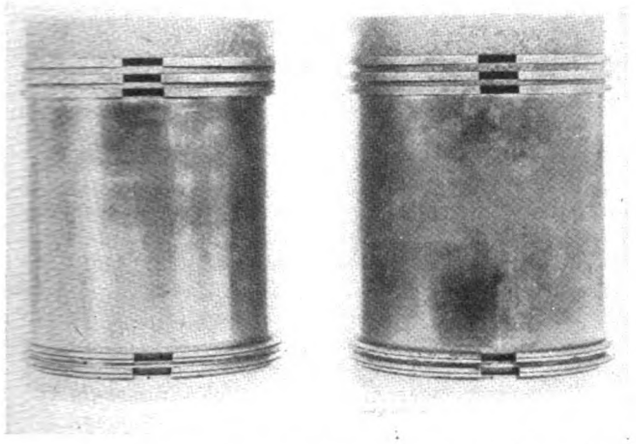
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RAILWAY Mechanical and Electrical Engineer

Heavy-Duty Diesel Oils*

By Wayne Lasky, M. A. Hanson and H. E. Frank†



Pistons from 1,000-hp. passenger engine. Left—heavy-duty oil. Right—straight mineral oil.

THE FIRST diesel engines on the G. M. & O., placed in passenger service in 1935, used a straight mineral oil. It was found necessary to renew pistons and liners every 25,000 miles and to change lubricating oil every 2,500 miles.

Laboratory analyses of periodic crankcase oil samples indicated that better oil quality would be maintained if filtering of the oil could be accomplished on the locomotive. Waste packed filter elements were applied.

Filter paper spot tests were used as a measuring stick of oil cleanliness. The filter paper selected for use was a .023 in. thick filter press paper.

The improved oil cleanliness by filtering also improved engine conditions. Piston and liner life was extended to 100,000 miles. Oil drain mileage was progressively increased from 2,500 to 100,000 miles and finally the oil was changed only at times of excessive contamination with fuel oil, water or a mechanical failure. Credit for a portion of the improved engine conditions should probably be given to improved injection equipment which was installed at almost the same time as the filters.

The engine parts in the hot areas were generally quite heavily lacquered and sludge deposits were rather heavy in the cooler locations of the engines. This was accepted as a normal condition.

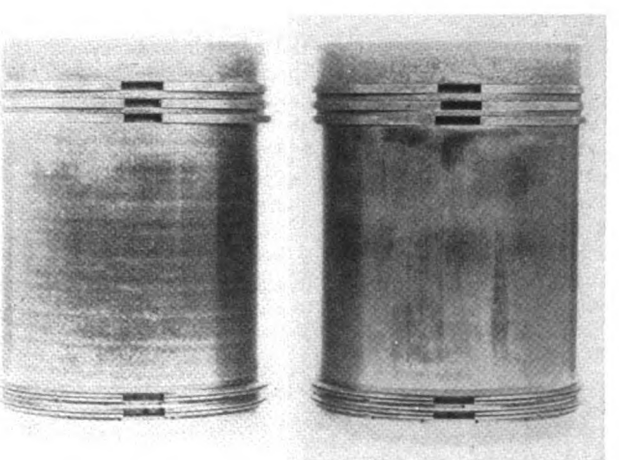
In 1945, a number of new diesel passenger locomotives were purchased. At that time one of the oil companies offered a heavy-duty type oil which was placed in these engines and immediately differences were noted in the characteristics of the lubricating oil samples removed from the crankcases. The filters did not keep the oil visibly clean. Blotter spot tests, which had been used for the control of filter changes, no longer appeared to have any value since the oil did not become clean by frequent and repeated changing of the filters.

Lubricating oil changes were being made every 50,000 miles in accordance with manufacturer's warranty recommendations; however, it was noticed that the oil was maintained considerably cleaner toward the end of the oil change period than at the beginning.

When these engines were out of warranty, it was decided to extend the oil mileages on one of the units. Crankcase oil conditions were closely followed. This included the determination of additive metal in the ash at periodic mileages.

Figure 1 is a graph of the analyses of the calcium content of crankcase oil samples plotted against mileage. It will be noted that the percentage of additive metal in the oil dropped rather rapidly during the first few thousand miles of service and then remained at a uniform concentration for an indefinite period.

It was generally accepted that the percentage of additive metal present in used oil samples was indicative of the original additive remaining in the oil. It appeared



Pistons from 1,500-hp. freight engine, with heavy-duty oil. Left—fortification test. Right—30,000-mile oil changes

* Abstract of a paper presented before the Society of Automotive Engineers, National Diesel Engine Meeting held at Chicago, November 2-3, 1950.

† Engineer of tests, engineer of research and chief chemist, respectively, Gulf, Mobile & Ohio.

that the additive in the make-up oil used was sufficient to maintain the additive concentration in the crankcase at a constant value.

After 155,000 miles of service it was necessary to remove one cylinder assembly from the engine on extended oil mileage, due to a parts failure. The condition of the piston, the rings and bearings was so much better than any previously inspected that the benefits from heavy-duty type oil were clearly established. At that time it was decided to extend the oil mileage on all these engines and to change oil in the crankcase only as required by fuel dilution, water in the oil or a parts failure. Some engines were operated 300,000 to 400,000 miles between oil changes. Extended oil mileages on these engines resulted in no particular engine difficulties. The condition of the removed parts were excellent and the engines remained reasonably clean, in fact, much cleaner than had been previously possible with straight mineral oil.

Late in 1946 the railroad purchased its first freight diesel locomotives equipped with higher output engines. Some of these engines were identical to the passenger engines except that they had more cylinders and the

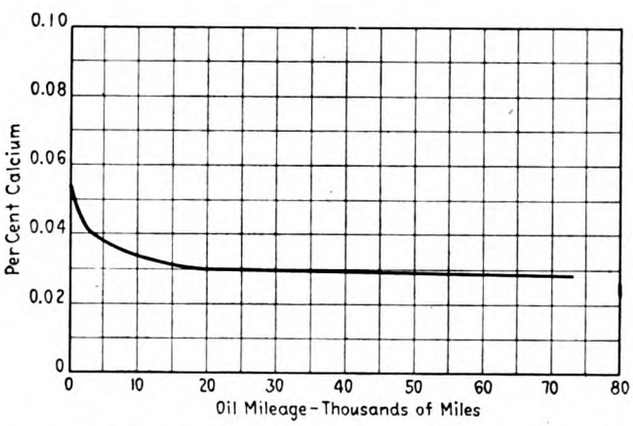
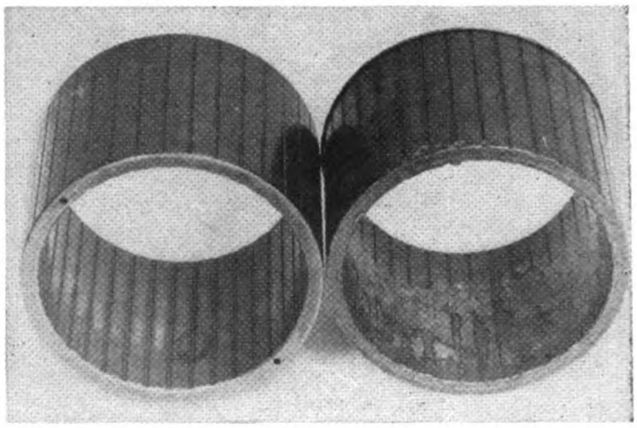


Fig. 1—Calcium content of crankcase oil plotted against mileage. Samples from a 1,000-hp. passenger diesel. The calcium present at the end of the test was about 60 per cent of that in new oil

horsepower output per cylinder had been increased approximately 12 per cent by the injection of more fuel per power stroke.

The oil was changed in these engines every 30,000 miles during the warranty period. A portion of the engines was lubricated with straight mineral oil but it was soon found that this type oil was not satisfactory. Although the oil could be kept clean by periodic filter changes, the engine parts became heavily coated with lacquer and sludge. Heavy sludge deposits accumulated on the top decks and crankcases. A heavy build-up of carbon and lacquer was experienced on the valve stems contributing to valve blow-by and stuck valves. Compression rings were found stuck and oil control rings filled. Oil grooves in the piston pin bushings also became filled, thereby preventing adequate lubrication and causing seizure of the bushing to the rod eye and/or piston pin.

Oil cooler passages became partially filled with sludge which resulted in higher crankcase oil temperatures. Higher oil temperatures in turn resulted in a more rapid rate of sludge and varnish formation. The oil became



Piston pin bushings from 1,500-hp. freight engine. Left—heavy-duty oil. Right—straight mineral oil

increasingly reddish-brown in color which was readily noticeable on the blotter spot tests. Frequent changing of lubricating oil filters appeared to remove the black portion of the sludge in the oil but seemingly had little effect on the reddish-brown material.

It was suspected that in the high output engines, the moving parts in the piston area, that had to be lubricated, were operating at a higher over-all temperature than those in the passenger engines due to the combustion of more fuel per cylinder. This could have been one of the contributing factors of the failure of straight mineral oil to lubricate these high output engines satisfactorily.

In a short time, all of the diesel freight locomotives were assigned to heavy-duty type oils which were being obtained from three different suppliers.

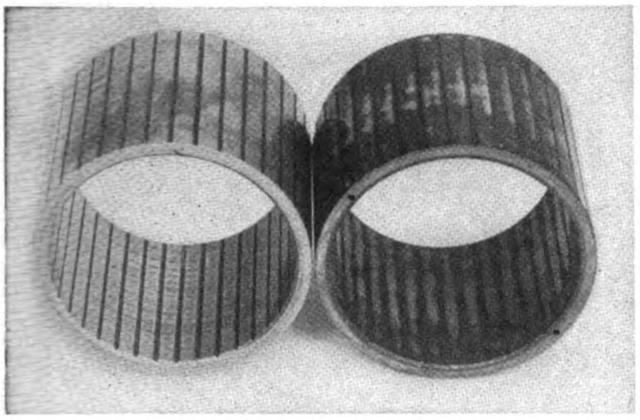
Since satisfactory and economical lubrication had been experienced with these oils in passenger engines on extended oil mileages it had been planned to place these high output freight engines on extended oil mileages after the warranty period.

However, it was soon discovered that after 30,000 to 35,000 miles the oil in the crankcase appeared to have properties similar to straight mineral oil. Continued operation of the engine without changing oil produced unsatisfactory engine conditions similar to those experienced when using straight mineral oil in these high output engines. There was no noticeable difference in the results experienced with any one of these heavy-duty type oils used.

Analyses of periodic oil samples removed from the crankcase indicated that the oil became less oxidation stable, and lost its dispersant qualities rapidly between 20,000 and 30,000 miles.

Figure 2 shows the analyses of naphtha insolubles, also the chloroform soluble and chloroform insoluble portions of the naphtha insolubles. The determinations were made at periodic oil mileages of crankcase oil samples removed from a 1,500 hp. freight engine, lubricated with heavy-duty oil, from the time the oil was applied to approximately 50,000 miles of service.

For interpretation of the oil conditions we shall assume the naphtha insolubles roughly represent the total sludge contaminants in the oil. The chloroform solubles indicate the amount of oil oxidation products such as resins, gums, acids, etc. The chloroform insolubles are a measure of the carbon or soot "blow-by" contained in the oil. Of course, in every instance the naphtha in-



Piston pin bushings from 1,500-hp. freight engines, with heavy duty oil. Extended oil mileages. Left—with fortification. Right—without fortification

solubles equals chloroform solubles plus chloroform insolubles.

The naphtha insolubles increased rapidly during the first 6,000 miles, however the naphtha insolubles consisted mainly of chloroform insolubles indicating only a small amount of chloroform solubles was being produced by the engine due to good oxidation stability. The rapid increase of chloroform insolubles in the oil was due to the high dispersancy which kept the sludge suspended in finely divided particles that were not removed by the filter.

After 6,000 miles the naphtha insolubles decreased rather rapidly for about 4,000 miles indicating that the sludge was being removed by the filters, probably due to the oil becoming less dispersant. This condition correlates with the rather rapid drop in additive concentration during the first few thousand miles as was shown in Fig. 1.

From about 10,000 miles to 22,000 miles the chloroform solubles increased at a low uniform rate indicating fair oxidation stability. The chloroform insolubles remained rather constant showing satisfactory dispersant qualities.

After 22,000 miles the amount of chloroform solubles increased more rapidly indicating lower oxidation stability. The chloroform insolubles decreased rather rapidly showing lower oil dispersancy, enabling the filter to remove the carbon and soot more completely. By the time the oil was drained at 48,000 miles, the naphtha insolubles consisted almost entirely of chloroform solubles.

It was concluded that the increased rate of oxidation and loss of dispersant properties were due to loss of additive effectiveness which was responsible for the unsatisfactory lubrication of these engines when operated more than 30,000 miles between oil changes.

Laboratory oxidation bench tests of the periodic oil samples also indicated the oxidation stability of the oil decreased with service miles. No satisfactory laboratory test was developed to measure the relative dispersant qualities of the oil; however, it was found that the appearance of the oil spots of the blotter spot test changed gradually as the oil mileage increased.

Blotter spot tests of crankcase oil samples taken from 1000 miles to 46,000 miles of service showed that after about 11,000 miles, the oil became progressively less dispersant as the mileage increased. This was indicated by the smaller diameter of the black portion of the spot until the black portion disappears entirely. Oil oxidation products increased with mileage as indicated by the gradual change of the outer portion of the spot from a pale yellow to an orange-brown. After correlating numerous spot tests with actual oil analyses it was possible to determine when the filters should be replaced and also possible to determine when the additive effectiveness had been reduced to the extent that the oil quality could not be maintained and an oil change was required.

TABLE I—LUBRICATING OIL COSTS. 1,500 HP. FREIGHT ENGINE; 200 GALLONS CRANKCASE CAPACITY; 12 GALLONS PER 1,000 MILES OIL CONSUMPTION; 90,000 MILES SERVICE

30,000 Mile Oil Changes

	Gal.	Cost Per gal.	Cost Total
3 oil changes	600	$.50	$300.00
Make-up oil	1080	.50	540.00
Total			$840.00
Crankcase Fortification			
1 oil change	200	$.50	$100.00
Make-up oil	810	.50	405.00
Fortification agent	270	.65	175.50
Total			$680.50
Saving (19%)			$159.50

It is possible the rather severe loss in oxidation resistance would have been overlooked had not the engine conditions noted during the inspections so clearly indicated that something was wrong. It was possible for a trained observer to accurately estimate the mileage elapsed since an oil change by inspecting the engines, providing the engine had been cleaned at the time of the last oil change.

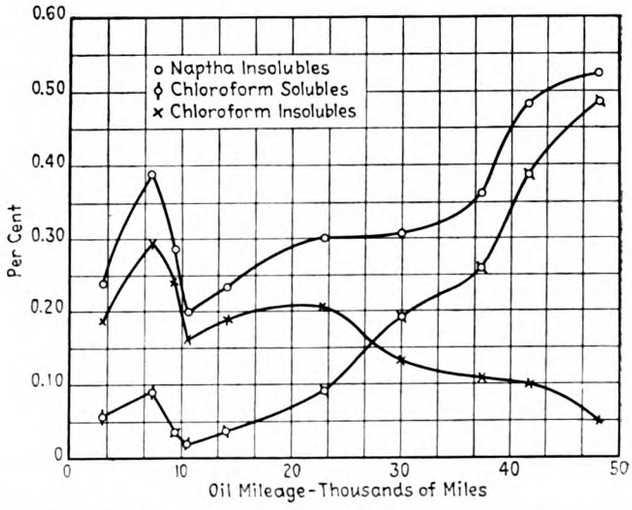
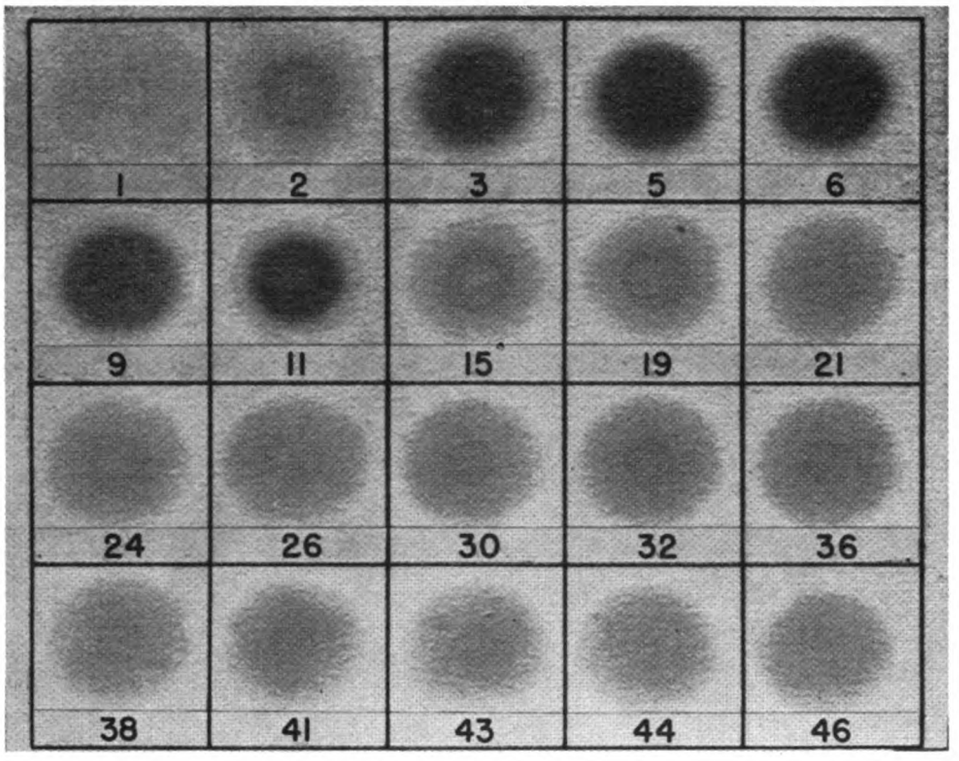


Fig. 2—Naptha insolubles, chloroform solubles and chloroform insoluble portions of naptha insolubles versus oil mileage. 1,500-hp. freight engine with heavy-duty oil

Due to the oil and engine conditions found, the oil in these high output engines was changed every 30,000 miles while an attempt was being made to determine the reason for the undesirable conditions encountered with extended oil mileages.

Even though analysis of the oil for additive metal indicated that a considerable portion of the additive



Blotter spot tests. 1,500-hp. freight engine with heavy-duty oil. (Oil mileage in thousands)

was still present in the oil during extended oil mileages, the performance of the oil and the conditions of the engines indicated that the additive had ceased to function. It was then assumed that the additives themselves must undergo some change causing them to lose their original properties and cease functioning as anti-oxidants and dispersants.

Cooperative research with one oil supplier resulted in methods of correlating engine conditions with several laboratory tests of the used oil. Dark field microscope inspections were found to be reliable for determining dispersant properties of oils. The total base number (TBN-E) was found to indicate rather accurately the amount of active additive remaining in one heavy-duty type oil.

In June 1948, arrangements were made to conduct a full scale field test to determine if periodic additions of the original type additive to the oil in the crankcase would maintain satisfactory oil quality and engine conditions.

Five high output railroad diesel freight units in good mechanical condition were selected. These units included two different engine builders' locomotives each powered with a 1,500 hp. diesel engine.

A full charge of 200 gal. of new lubricating oil and new lubricating oil filters were applied at the start of the test. Filters were changed as usual every 5,000 miles on one type engine and every 6,000 miles on the other. At each filter change 15 gal. of additive concentrate were added directly to the crankcase.

The additive concentrate consisted of the same base oil as used in the engine but contained five times the amount of additive contained in the new oil. By adding 15 gal. of concentrate, the same amount of additive was placed in the crankcase as was contained in 75 gal. of new oil. The tests on some of the units were interrupted on a few occasions by the need for oil changes due to excessive fuel or water in the oil. Other tests were interruped by oil changes made by maintenance forces, due to an oversight that the unit was on test.

However, several of the engines were operated with extended oil mileages including one run of 136,698 miles, another of 118,474 miles and another of 117,078 miles before the oil was drained. The oil in each instance was drained on account of work required on the engine or by error and not because of the oil quality.

Periodic inspection of these engines during the entire test have shown them to be satisfactorily clean. Sludge deposits and lacquer conditions have at all times been

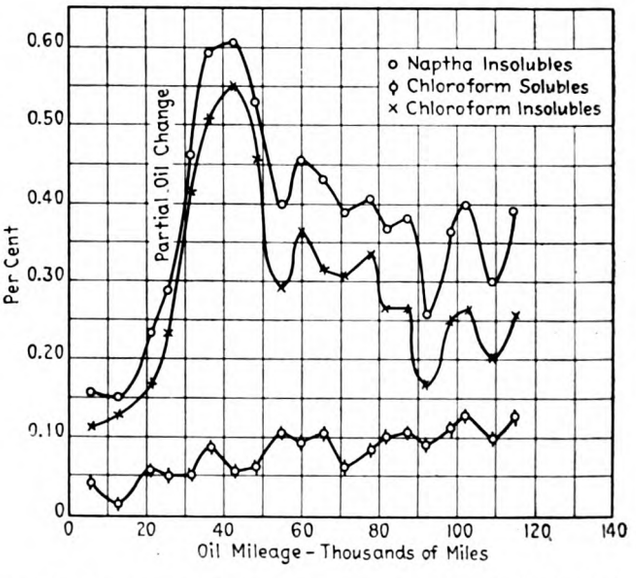
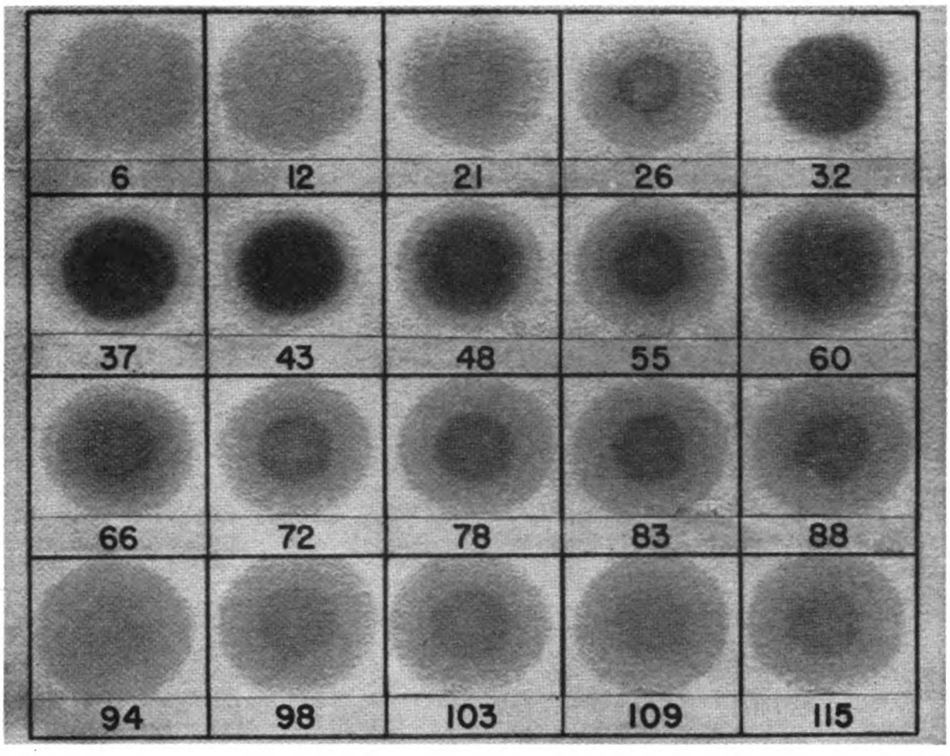


Fig. 3—Analyses of oil content versus mileage similar to that shown in Fig. 2. 1,500-hp. freight engine using heavy-duty oil with periodic fortification



Blotter spot tests of oil samples used for Fig. 3

comparable to conditions existing on engines operated on heavy-duty oil with low mileage oil changes.

Examination of the parts removed from these engines disclosed the pistons, rods, and bearings to be at least as clean as those removed from engines which were regularly oil changed every 30,000 miles and much cleaner than those run for extended mileages without additive additions.

Figure 3 is a graph showing the analyses for naptha insolubles, chloroform solubles and chloroform insolubles of periodic oil samples removed from the crankcase of one of the engines in the crankcase fortification test. The samples start at 6,000 miles and continue until oil was drained, by error, at 114,800 miles. There was a partial oil change on account of fuel dilution at 27,000 miles.

The naphtha insolubles, consisting almost entirely of chloroform insolubles increased rapidly for more than 40,000 miles, indicating very good dispersant qualities. The chloroform solubles, during this period, remained rather low, indicating good oxidation stability. Between 40,000 and 55,000 miles the naphtha insolubles and chloroform insolubles decreased at about the same rate. After 55,000 miles the naphtha insolubles and chloroform insolubles remained rather constant although there was a gradual decrease until the end of the test. During this period the chloroform solubles showed only a slight gradual increase indicating the oxidation stability was satisfactory during the entire test. At all times, during the life of the oil, the chloroform insoluble was considerably greater than the chloroform solubles. The amount of chloroform insolubles present at all times indicated that the oil maintained satisfactory dispersancy.

Blotter spot tests of the oil samples used in Fig. 3 indicate little chloroform insolubles and the spots show very small amount of black deposits. As the chloroform insolubles increased up to the spot at 43,000 miles the black portion of the spot becomes more dense. In both instances, when the chloroform insolubles dropped rapidly as indicated by the valleys in the graph at 55,000 miles and 94,000 miles, the oil spot shows considerably less black material than the previous spot. The oil remained less dispersant after 66,000 miles as indicated by the smaller diameter of the black portions of the spots. However, dispersancy was still satisfactory at the end of the test. The oxidation products increased slightly during the test as indicated by the change of the outer portion of the spot from yellow to light orange.

TABLE II—ADDITIVE ADDED TO CRANKCASE OIL 12 GAL. PER 1,000 MILE OIL CONSUMPTION; 90,000 MILES SERVICE

	Gal. additive
Regular Crankcase Fortification	
810 gal. make-up oil (3% additive)	24.3
270 gal. Fortification agent (15% additive)	40.5
Total additive added	64.8
High Additive Oil	
1,080 gal. make-up oil (6% additive)	64.8

It was found that the ash content of the periodic oil samples from the engines under test did not reach as high a percentage as expected. The ash content of the new oil used was 0.4 per cent.

The ash content gradually increased to 0.6 per cent or 0.7 per cent during the first 35,000 to 45,000 miles. From that time on until the end of the test the ash content fluctuated within narrow limits near this percentage. No actual explanation for this condition has been developed.

The results of the field test indicate that the percentage of additive metal in the crankcase oil is not indicative of the original additive remaining in the oil; that some reaction takes place with the additive in service which reduces its effectiveness; that high output diesel freight engines in heavy freight service can not be operated

satisfactorily for extended oil mileage with some of the heavy-duty oils available today. Previous experience indicated that they could not be operated satisfactorily with the straight mineral oils offered to the G. M. & O.; and that by periodic replacement of the additive in the crankcase oil, these engines can be operated satisfactorily for extended oil mileages with some heavy-duty oils.

Periodic additive addition which we call "crankshaft fortification" was started on a fleet of high output engines in freight service. Sufficient time has not elapsed since this project was started to be certain of the final results obtained.

It is more economical, based solely on the cost of new lubricating oil, to operate high output diesel engines for extended oil mileages with crankcase fortification than to change oil when the normal additive appears to become ineffective.

After complete dieselization of the railroad, it was found necessary to reclaim the crankcase drainings. Lubrication with fortification of the crankcase eliminates at least two oil drains per year per engine. The oil recovered from an oil drain averages about 175 gal. which indicates a reduction of 350 gal. of crankcase drainings per year per engine.

By lubricating the fleet of 50 high output freight engines with fortification of crankcases, we expect to reduce new lubricating oil costs approximately $8,000 a year and reduce the accumulation of crankcase drainings approximately 17,500 gal. per year.

If improved additives are not available it may be possible to secure extended oil mileages by increasing the amount of the additive contained in the new oil so that the total amount of additive supplied to the crankcase over a given period would be equal to the amount of additive supplied by the fortification procedure discussed.

To illustrate, let us use as an example one of the freight engines on test that requires 12 gallons make-up oil per 1,000 miles. The oil used contained, 3 per cent by volume, additive. Fifteen gallons of fortification agent containing 15 per cent additive was added every 5,000 miles.

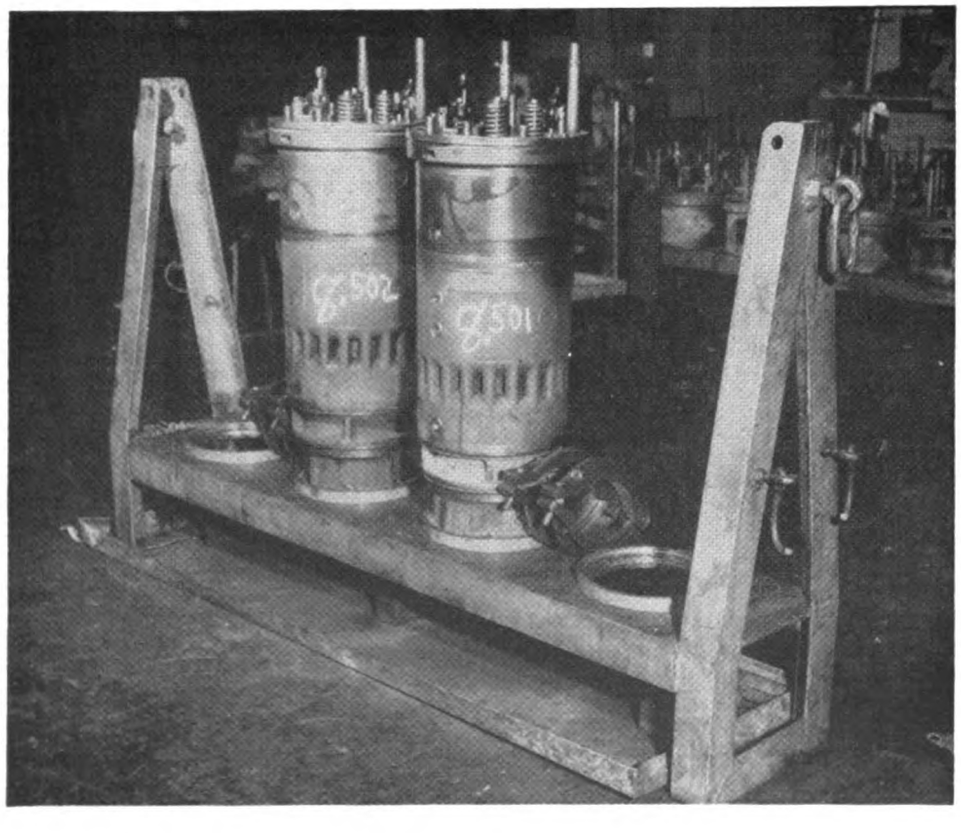
Table II shows the total amount of additive in gallons added to the crankcase over a period of 90,000 miles by the above method which was used during the test. It also shows the amount of additive that would be added if an oil of the same type but containing twice the amount, or six per cent additive was used.

Inasmuch as make-up oil is usually added every 500 to 1,000 miles, the concentration of effective additive in the crankcase should remain more constant when high additive oil is used than when a large amount of additive is added at each 5,000 mile filter change.

Therefore, high output diesel engines in heavy freight service probably could be satisfactorily lubricated for extended mileages with the present heavy-duty oils available if the additive content of the oils were increased. It is doubtful that the advantages of higher additive oils in high output railway diesel engines could be determined by the usual 100 hr. or 500 hr. laboratory engine tests. It is believed that these tests are comparable to no more than 25,000 to 30,000 miles of heavy freight service.

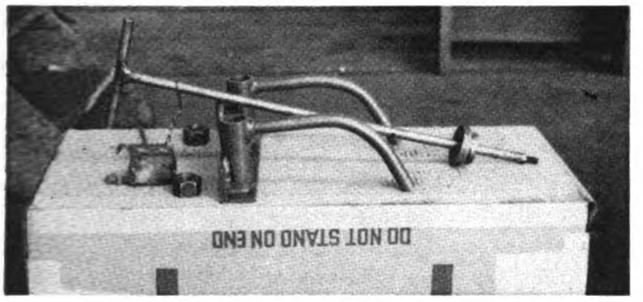
It is believed that the use of higher additive oil offers sufficient promise of being able to operate with extended oil mileages to permit a full scale field test to determine the results which could be obtained.

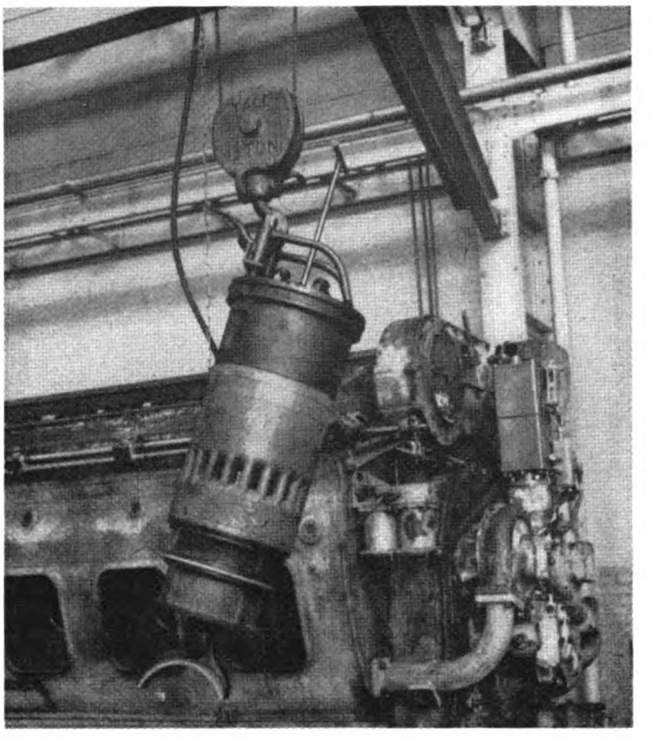
* * *



Rack used by the Southern's Spencer, N. C., shops to hold a complete assembly of liner, piston, head and liner gasket. A channel iron goes across the top and has three holes per head. Two are for eyebolts that hold the head and one for an eyebolt that supports the piston

Simplifying Diesel Work

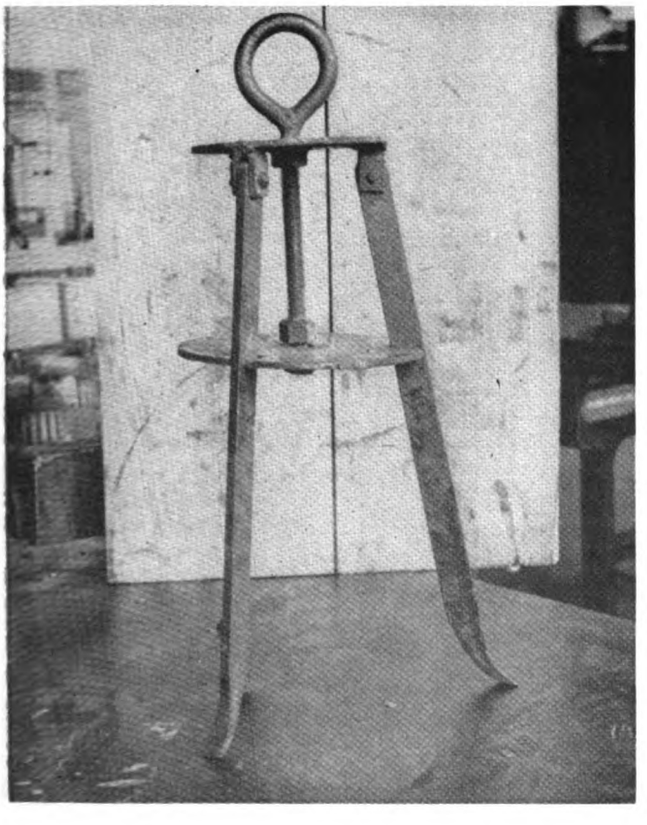


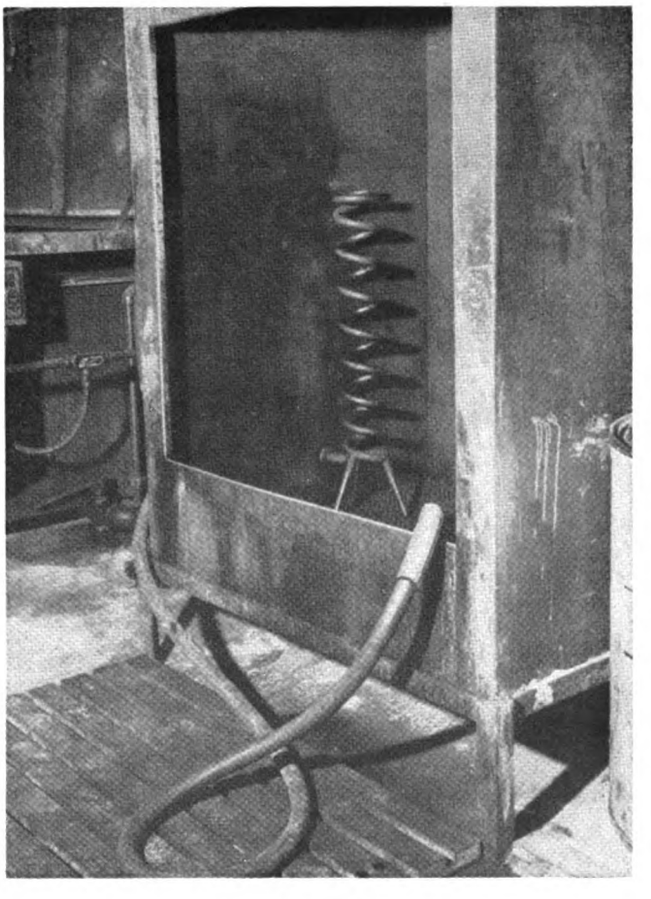


Above: A cylinder assembly used on the Chicago, Burlington and Quincy. Right: The lifting portion slips over two rocker arm studs and has a U-shaped rod for the crane hook. A T-bar with a washer and a taper pin prevents the piston from falling through and a wooden block for holding the rod central in the liner is attached to the T-rod by a chain.

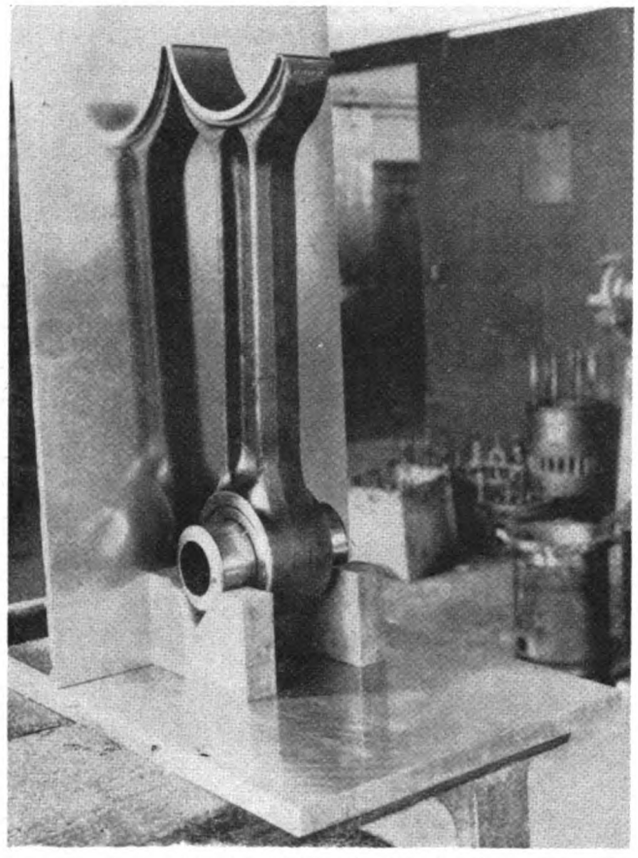
Below, left: A lifting stand for steam generator coils used on the Wabash which is lowered into place and the legs moved out by a threaded rod and nut. The eyebolt is for the crane hook.

Below, right: A coil, also used on the Wabash, for cleaning 100-mesh screens of Nugent strainers. The strainer is slipped over the coil and steam blown through a series of 1/16-in. holes in the coil. The steam is for cleaning the strainers after steaming.





Connecting Rod and Wrist-Pin Checker



Arrangement used by the Wabash for checking both connecting rods and wrist pins

At the Decatur, Ill., shops of the Wabash a pair of perpendicular faced plates are used in conjunction with surface gauges to check wrist pins and connecting rods on Electro-Motive and Alco-G.E. equipment. The arrangement checks the rods for both twist and proper bearing-to-bearing dimension.

The wrist pins are checked resting in on a pair of V blocks. As the blocks and the two plates are both faced and ground, the wrist pin is parallel to both plates for accurate checking. The bottom plate extends a sufficient distance forward of the vertical plate and the blocks to permit easy maneuverability of the surface gauge and dial indicator used to check the wrist pin.

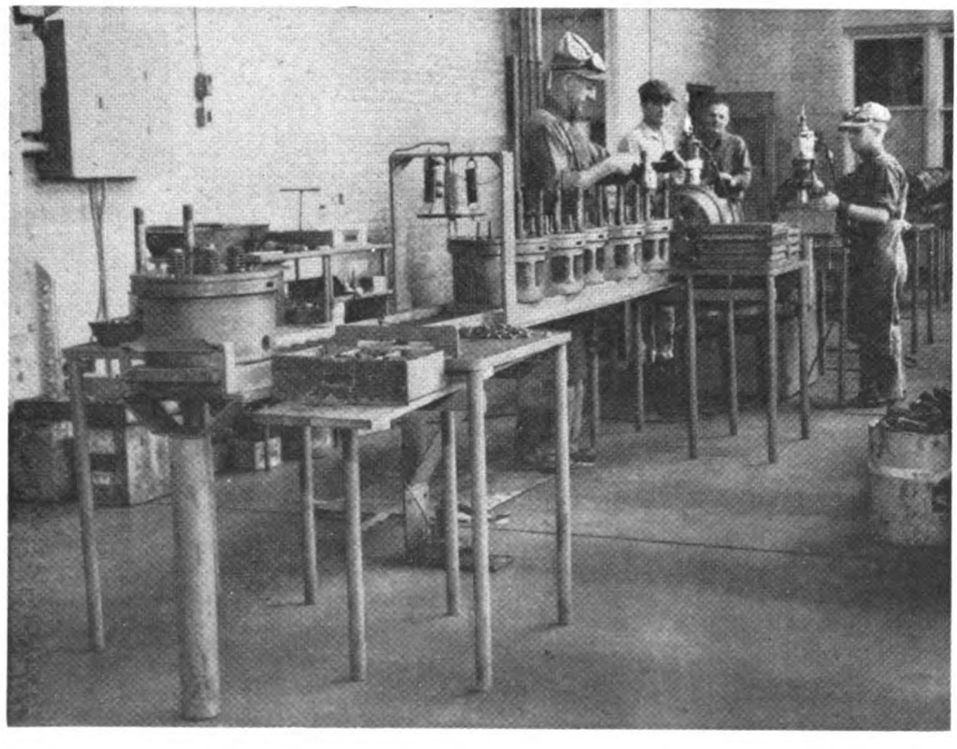
Rods are checked with the wrist pin in place in the rod and resting in the V blocks as it did above. An extension is used to mount the surface gauge and dial indicator for checking the crankshaft bearing end of the rod.

Assembly Line for Cylinder Heads

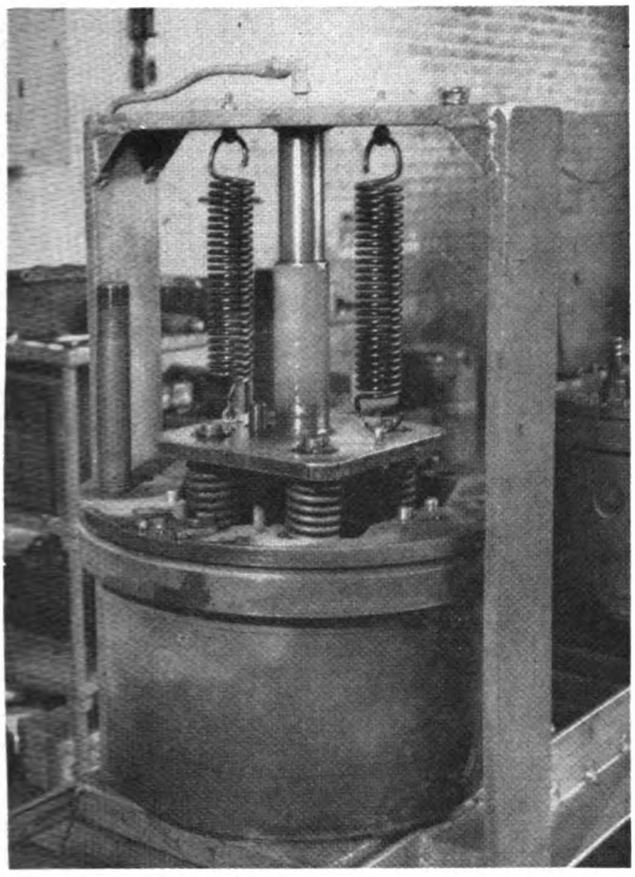
The Chicago, Burlington & Quincy has placed the reconditioning of diesel-engine cylinder heads on an assembly line basis at the West Burlington, Ia., shops. The heads arrive in the assembly line area dismantled, cleaned and faced on the liner seat. All of the subsequent operations are performed on the cylinder head assembly line.

Operations performed on the assembly line conveyor include finish cleaning, inspection, and buffing out the valve-guide holes and the liner stud holes. The latter operation is performed to prevent dirt from the threads being knocked off on the seat when the head is applied over the stud threads.

The remaining operations include water-pressure test-



Assembly line for reconditioning diesel cylinder heads. In the foreground is the hydraulic arrangement for applying the half collets; in the background, the grinding area equipped with a vacuum exhaust system located underneath the bench



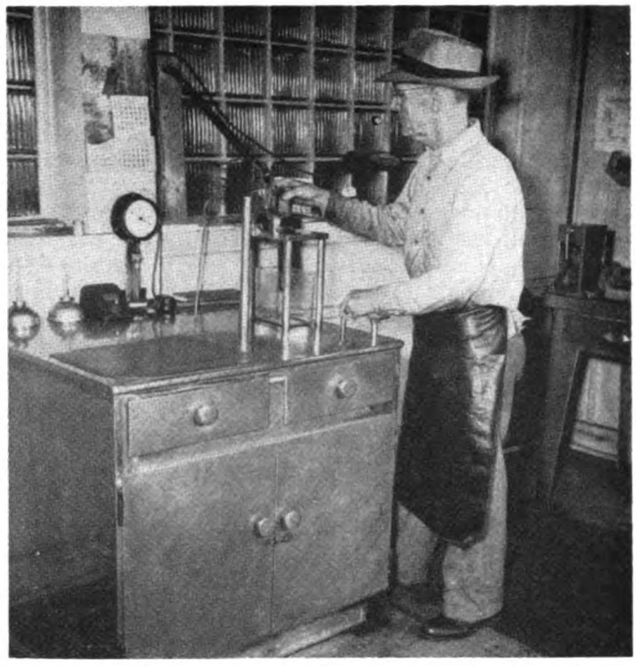
The foot-controlled hydraulic-pump-operated spring depressor for applying the valve half collets

ing at 60 lb., grinding the valve seats, applying and kerosene testing the valves, chasing the studs, and applying the springs and half collets. The application of the springs and lock-spring seats is done on a special fixture, operated by a foot-controlled hydraulic jack, which compresses all four springs simultaneously for application of the half collets. The valve-grinding area is equipped with a vacuum exhaust system located under the bench on which the valve grinders are mounted.

Air Clamp For Injector Pop Tester

The time required for tightening and untightening the fuel connection stud nuts on Diesel engine injectors is eliminated by a pneumatic clamp attachment on the pop tester used at the Spencer, N. C., shops of the Southern. With the attachment, a block is pneumatically clamped on the filter cap to make a fuel-tight connection for checking the pressure at which the nozzle begins to spray.

The clamp is actuated by an air cylinder which is located in the work bench compartment and is 5½ in. in diameter with a 1-in. stroke. An extension shaft on the piston rod actuates a lever mounted horizontally with its fulcrum at the center. When this shaft is raised by the cylinder air pressure the block is lowered and clamped in place through the lever. The block mates with the fuel

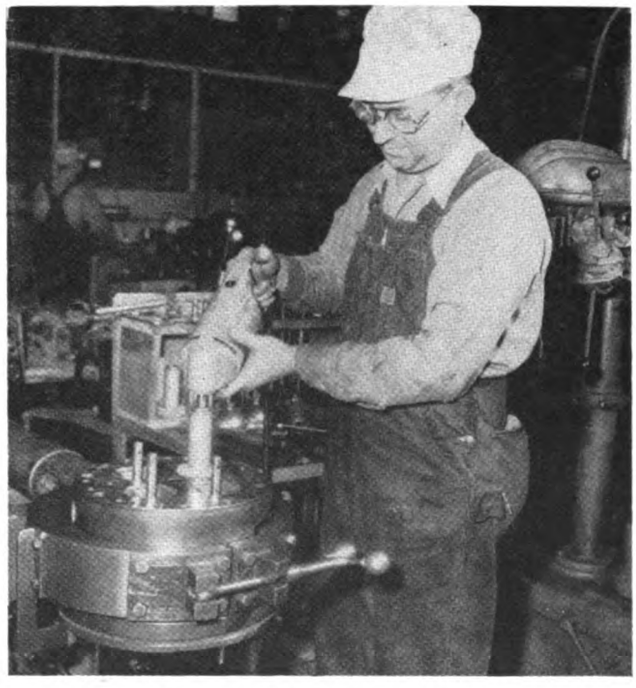


Pneumatic clamp for checking nozzle spray pressure

openings in the filter cap and has a pipe connection to the pop tester fuel tank.

Stand to Grind Diesel-Engine Heads

Grinding valves on Diesel-engine heads is simplified by using a head stand of the type built at the Southern shops in Spencer, N. C. The stand is mounted on two 4-in. flues



Head stand for grinding valves

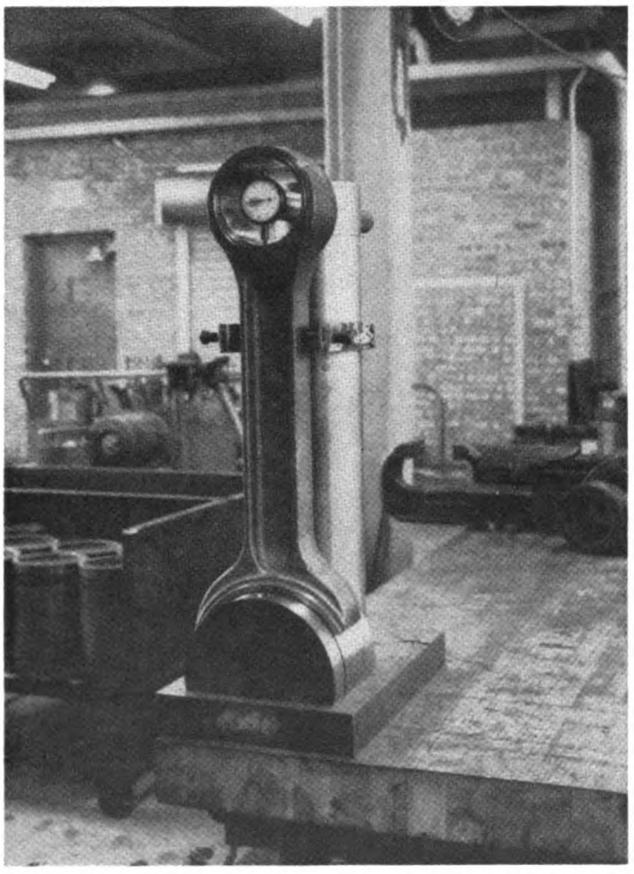
29 in. high and 11 in. apart which are threaded on top to receive two elbows. A third flue 19 in. long connected to the head clamp on one end pivots about a 3-in. shaft to load the head on the stand or to position it for grinding the valves.

A ratchet lock on the front elbow holds the head in a horizontal position for grinding any one of the valve seats. The head holder itself is in two semi-circular halves which pivot on hinges to clamp the head.

Each half has a varying cross section, thick near the flue for mounting purposes and thin on the opposite side to lessen the weight. The head rests on brass that fits in a shoulder in each half of the holder.

Connecting Rod Alignment Checking

Connecting rods are checked for twist and bearing center-to-center distance with a dial gauge mounted on a holding fixture at the Chicago & North Western Kinzie



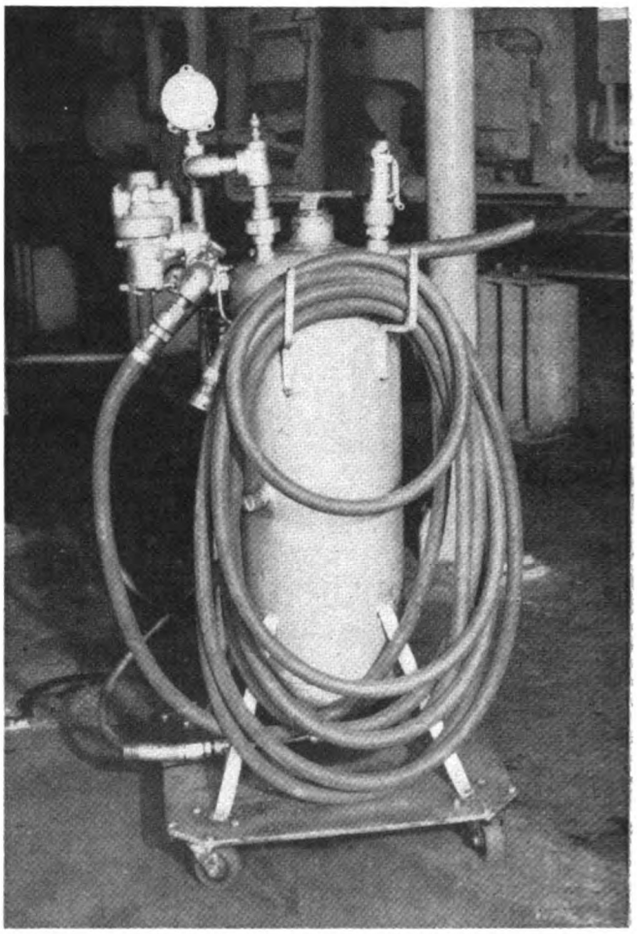
A dial gage mounted on this holding fixture checks connecting rods for both twist and bearing center-to-center distance.

street shops in Chicago. The main bearing end of the rod fits over a piece of half-round stock with a radius equal to that of the rod bearing, and the body of the rod is held in an upright position by set screws mounted in a bracket a little above the center of the rod.

A dial gauge is mounted on a shaft which has a common center line with the wrist pin bearing of the rod. The shaft is free to move in and out, and to turn. Moving the gauge in and out checks the rod for twist, while turning it checks the bearing center-to-center distance of the rod.

Buggy To Fill Traction Motor Support Bearings

The Wabash has built, at its Decatur, Ill., shops, an easily movable buggy for filling the traction-motor support bearings on Alco-G.E. locomotives. The buggy holds 15 gal. of oil which is delivered to the support bearings by air pressure furnished from the shop air



Buggy for filling traction-motor support bearings on Alco-G. E. locomotives

system through a reducing valve set at 45 p.s.i. The tank is equipped with a safety valve set at 50 p.s.i.

The oil is delivered to the support bearing until the gauge on the nozzle starts to rise, which shows that the support bearing is full. Flexibility is attained by equipping the buggy with 50 ft. of air hose and 12 ft. of oil hose. Damage to the nozzle is avoided by covering it with a rubber sleeve.

New Railway Car-Building and Repair-Shop Methods*

By C. R. Strutz†

RAILROADS can make important savings by taking advantage of improved modern methods, both as to new construction and repairs, thus reducing shop costs. One way of cashing in on the construction and repair savings, I believe, is closer cooperation between railway mechanical engineers and car manufacturers for new construction, and welding engineers for repair work in railroad shops.

For instance, in the case of new construction, railway mechanical engineers are responsible for the design of passenger and freight cars. With but few exceptions, every order of cars is tailor-made to suit the purchaser even though these cars may be used on other railroads a greater part of the time than on the owning line. Because one designer believes that a washroom should be in one corner of the passenger car and another designer thinks it should be in the opposite corner, the car structure must be largely built to order.

The A.A.R. has finally adopted a standard design for a welded box car. Two car builders are specializing in producing standard designs and, in that way, pass on the savings realized to railroad customers. In these new ideas, welding plays a dominant part. Yet it is apparent that much more research is necessary in stress analysis, etc., to overcome some of the failures that have developed. The car manufacturers are prepared to move forward and will overcome these difficulties.

In numerous instances, the advantages of welding have not been fully utilized at the time repair programs are still in the talking and design stage. Often, material is ordered and the program started before the welding advantage is noted resulting in inability to realize the total savings possible in material and labor. If some arrangements can be worked out whereby the welding engineer's know-how can be applied and combined with the railway engineer's knowledge before the details of the program are settled, marked improvement and economies will be realized by the railroad.

Unfortunately, some of the welded car designs are simply riveted designs changed to substitute welds for the rivets, often at the discretion of the shop. This may have been necessary in the past because of the ever-increasing orders and shortage of skilled and trained personnel.

The need of design changes on such short notice did not permit adequate studies to be made with the result that many of the advantages available from modern welding practice and equipment were not fully realized. This requires the utmost cooperation between the engineering departments and the shop.

The various welding processes have played an important part in the production and repair of railroad equip-

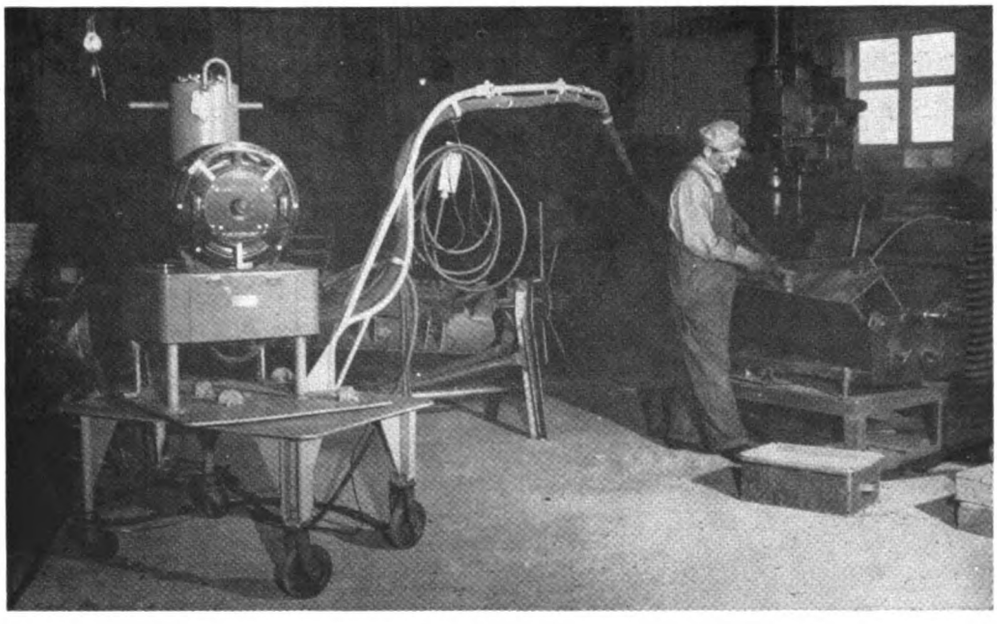


Fig. 1—Portable Unionmelt hand-welding unit and jig used in fabricating bolsters

* Abstract of a paper presented at the November 6 meeting of the Northwest Carmen's Association, St. Paul, Minn.

† Oxweld Railroad Service Division, Union Carbide and Carbon Corp.

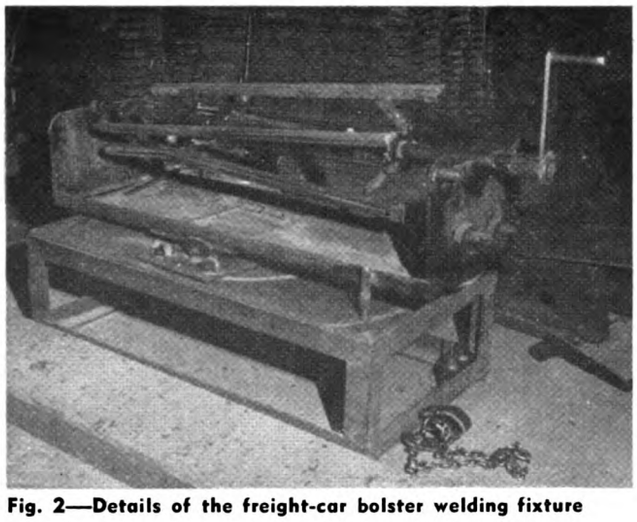


Fig. 2—Details of the freight-car bolster welding fixture

ment. There is always a need for more efficient welding which will extend the economical service life of car and locomotive equipment. Since railroads must continue as successful enterprises they should adopt and use these more efficient welding methods as a means to the better utilization of manpower and material.

The more recently developed streamlined, high speed rolling stock is the result of extensive research, designed to take advantage of any and all metals and alloys that have inherent physical properties most able to meet a definite service requirements. Many of the welding processes and procedures were adequate for the older type equipment but as newer types displace the older it is found that the quality requirements of welding place several of the older processes and procedures in a secondary position.

Typical Examples of Savings

The accompanying illustrations show some of the developments that have resulted in substantial savings to the railroads in material, labor and increased production.

The majority of Unionmelt welding applications on railroad equipment are best done with the automatic welding process, however, in some cases, the portable hand tool which is the latest development can be used to good advantage. With the automatic method of welding the head is moved across the seam by some mechanical means. With the hand welder the nozzle is moved along the seam manually. This type of unit makes it possible to do miscellaneous jobs, such as repairs on joints normally inaccessible for automatic welding. The speed of operation with the flexible welder is much greater than by other kinds of manual welding.

In Fig. 1 a general view of one of the flexible welders in operation is shown. Here the unit is mounted on an elevated table for easy positioning and the 20-ft. welding tube is partially supported with a flexible arm. This particular installation made it possible for a railroad shop to weld enough bolsters, crossbearers and center plates for

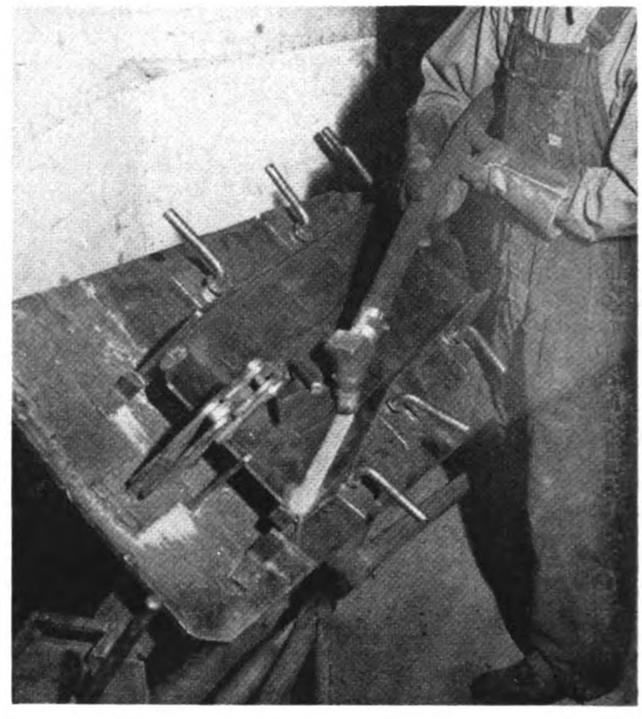


Fig. 3 (above)—Type of jig used in fabricating crossbearers



Fig. 4—Special jig which facilitates making center plates at low unit cost

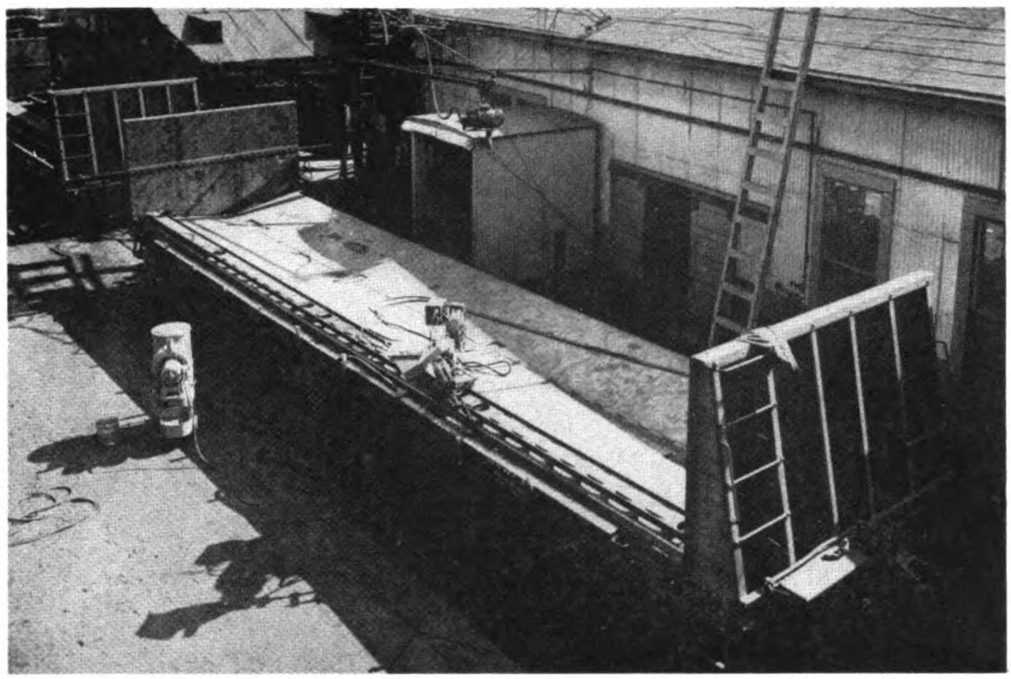


Fig. 5a—Rebuilt pulp wood car

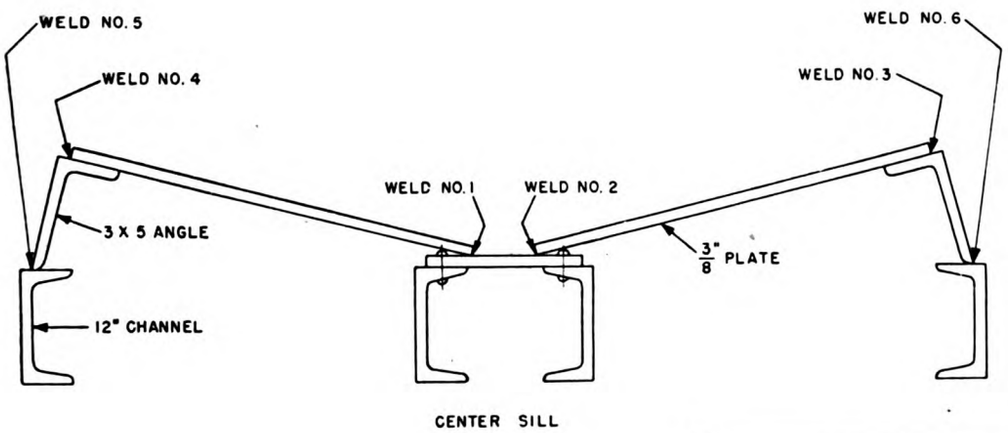
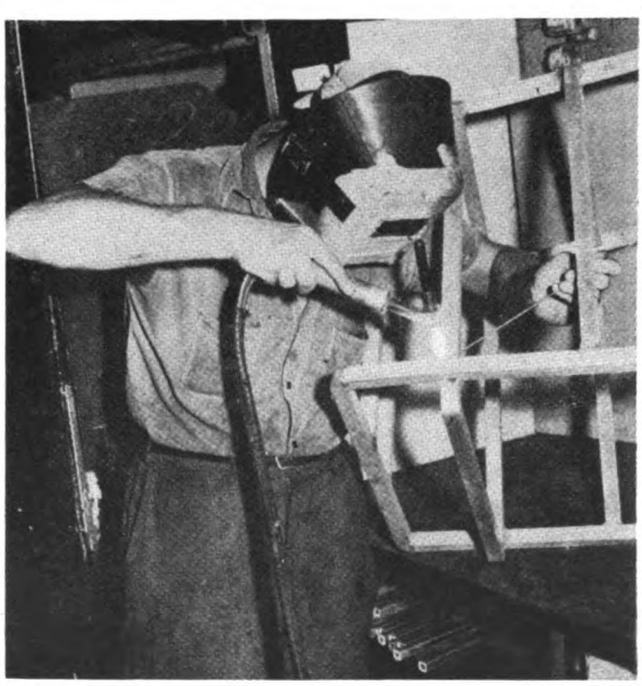


Fig. 5b—Unionmelt portable automatic equipment used in making welds at locations as shown in the diagram

Fig. 6 (below)—Aluminum lounge-chair frames being fabricated by Heliarc welding



a daily production of five cars. The welding unit was operated for three shifts a day using a welding operator and a helper. In this program several interesting fixtures were used.

In fabricating bolsters, the top and bottom cover plates and web plates are tack-welded together and then removed and placed in a fixture, the details of which are shown in Fig. 2. This fixture is quite interesting inasmuch as it has expandable copper back-up bars which are forced into the corners of the bolster. The fixture can be positioned in several different ways for downhand welding with the flexible welder. Bolsters with 5/16-in. web plates and ⅜-in. top and bottom plates were welded with 550 amp. of welding current at a speed of 22 to 26 in. per min. using ⅛-in. welding rod.

On this same car program, the crossbearers were welded in much the same manner on a jig shown in Fig. 3. All of these fixtures were made in the railroad shop at little expense and proved successful in every way. The welding of the center plates in the aforementioned program of five cars a day is shown in Fig. 4.

One operator and two helpers were able to weld 20 crossbearers and 20 center plates in eight hours. When

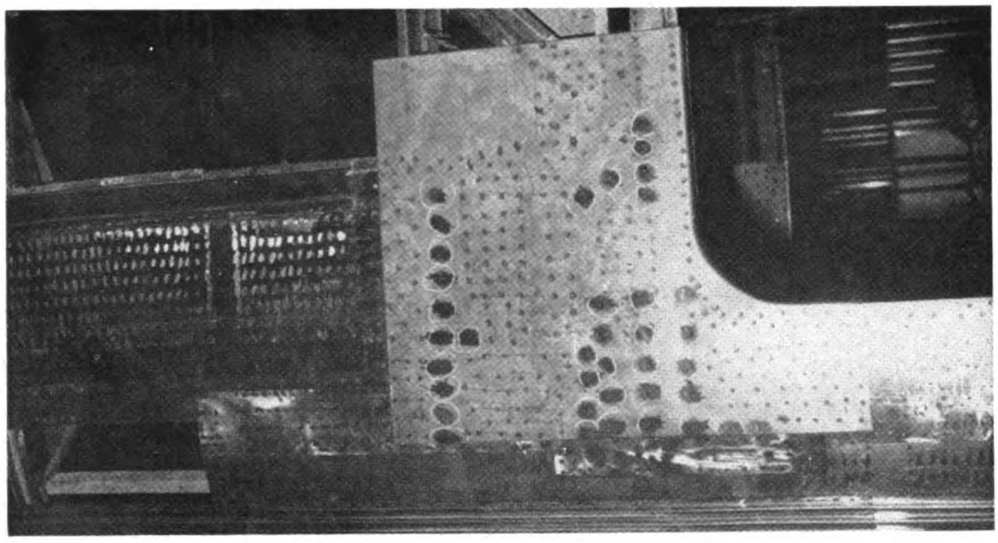


Fig. 7—How reinforcing sheet is applied to strengthen stainless-steel car-side member

welding bolsters alone, one operator and one helper produced 22 bolsters in eight hours. One flexible welding unit was able to produce 20 bolsters, 20 crossbearers, 40 cross ties and 10 center plates for the five-car-per-day production in a 24-hr. period using, in each case, one operator and one helper.

An interesting example of car rebuilding is shown in Fig. 5. In this program new floor sheets were applied to cars used for pulp wood service. The center sills, old and corroded, were flame cleaned before the new floor sheets were installed. The entire assembly of floor sheets and side angles was fitted and tack-welded and then Unionmelt welded with an automatic machine. The portable automatic welding machine was guided by a track placed directly on the floor sheet.

The welds at the center sill, Nos. 1 and 2, were made at 600 amp. at a speed of 16 to 18 in. per min.; Nos. 3 and 4 between the floor sheet and the side angles at 650 amp. at 32 in. per min.; and welds Nos. 5 and 6 be-



Fig. 8 (above)—Heliarc weld used in making repairs to a stainless steel car roof

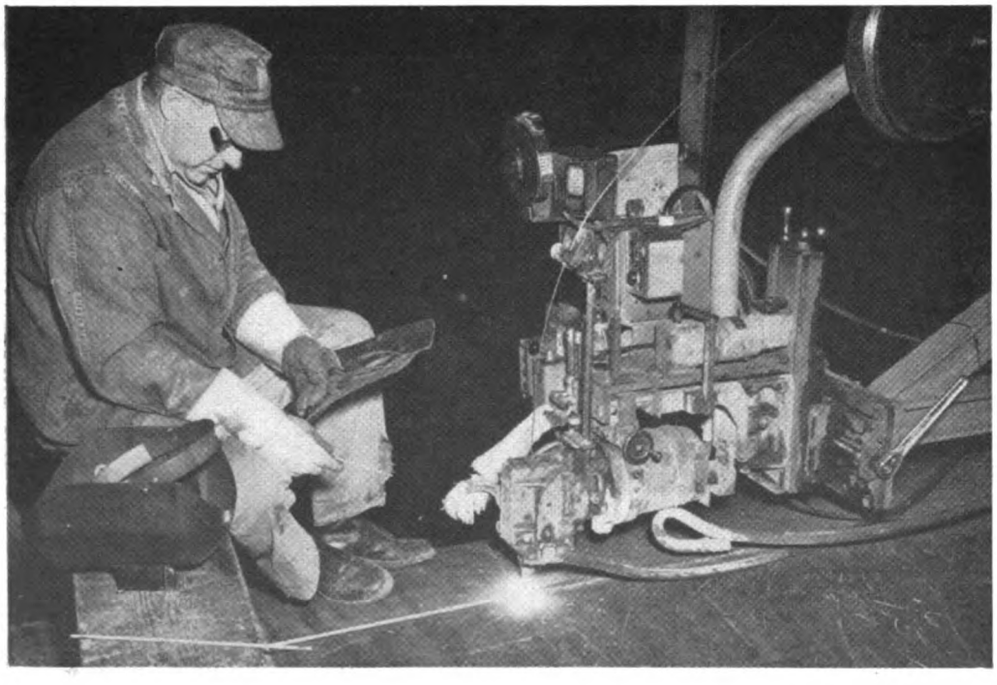


Fig. 9—Welding the longitudinal seam on a 1⅛-in. thick aluminum tank-car tank using an Argon metal arc-welding machine



Fig. 10—Welding aluminum anchors to an aluminum car tank with an Argon metal arc-welding hand unit

tween the side angle and the side sill at 550 amp. at a speed of 16 to 20 in. per min.

Heliarc welding is being applied with ever-increasing frequency to car work. In Fig. 6 vanity chairs and lounge chairs for passenger cars are being fabricated. The framework of these chairs is made of ¾-in. square aluminum tubing. This view shows an operator welding the frames of the chairs, each weld requiring two minutes. Welding currents of 150 to 175 amp. are used with an argon flow of 10 liters per min.

Figure 7 shows how the process can be applied to reinforce steel members. This view shows the side of a stainless steel passenger car where ordinary spot welds could not be used. Holes were drilled through the sheet and Heliarc welding was used to weld the sheet to heavy support members through the holes.

Heliarc welding is successfully used in making stainless steel passenger-car repairs to such parts as the roof shown in Fig. 8. The operator is making an edge weld in order to seal the joint between the channeled center section and the corrugated section. This had previously ben spot-welded and soldered. Leaks developed due to vibration and it was successfully repaired with Heliarc welding. In making this repair the joint was heated with an oxy-acetylene blowpipe to eliminate the solder and the channel was filled with wet asbestos to prevent distortion. No welding rod was used in this application.

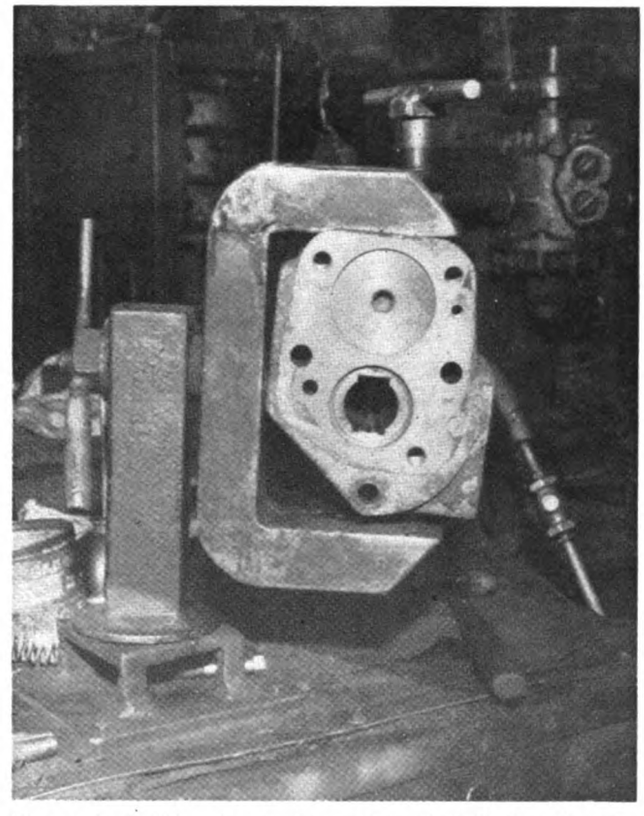
The Chicago, Burlington & Quincy has been reconditioning some of its old style suburban coaches and has utilized Heliarc welding to advantage. One particular application is the welding of roof sheets to new carlines. The old cars were of the double-deck roof type and are being converted to the turtle-back type. The carlines were made of 1½-in. angles and the roof sheets are ⅛-in. open-hearth mild steel. Sheets are spaced ⅛ in. apart and the weld is made with 3/32-in. Cromansil rod at 140 amp. of d.c. current. There are 27 roof seams per car, each 13 ft. 6 in. long. The particular advantage in this case is the great saving to be realized in the elimination of almost all of the grinding necessary to smooth down the joint. With the ordinary open arc electric welding the grinding costs were quite extensive requiring the removal of considerably more metal and spatter.

In the process of Heliarc welding, the arc generating the welding heat is formed between a tungsten electrode and the work. The welding rod is normally added manually and the weld zone is protected by a blanket of inert gas, usually argon. Recently a new method of welding, known as Argon metal-arc-welding has been developed. This process uses argon gas for a shielding medium and is used for Heliarc welding but the welding heat is generated between a consumable electrode and the work. In this regard it is similar to Unionmelt welding inasmuch as an electric rod feed motor is used to feed rod from a coil into the welding zone.

In Fig. 9 an Argon metal arc-welding machine is shown welding a longitudinal seam for an aluminum tank car. The tank is made of 1⅛ in. thick aluminum and is successfully welded at speeds substantially greater than was possible by manual Heliarc welding. All these welds are completely X-rayed and fully meet the rigid specifications imposed. The use of these machines has resulted in a substantial increase in the productive capacity of this car fabricating plant. Another application of Argon metal arc-welding by means of a hand unit is shown in Fig. 10. In this view an operator is welding aluminum anchors to a car tank.

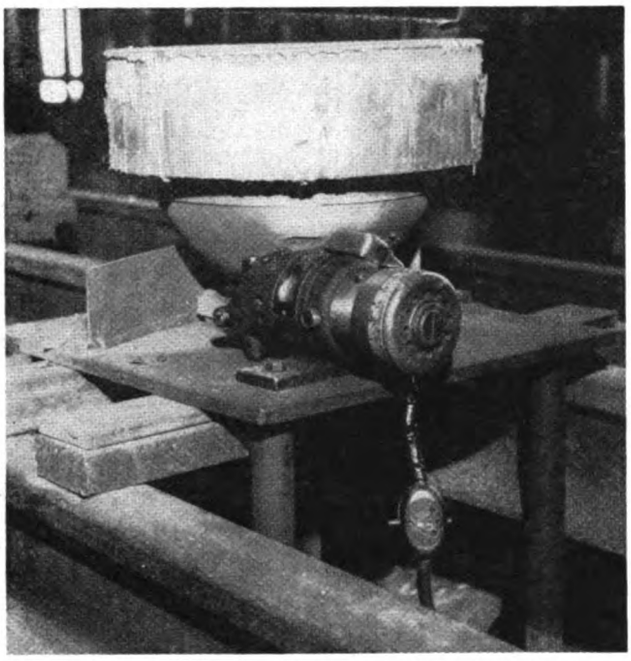
The future of welding on railroads and benefits to be derived therefrom are dependent on the cooperation of railroad engineering and shop forces and the welding industry. A tremendous saving in dollars and man hours may be realized from the use of welding which will assist the railroads in maintaining a strong financial position and also enable them to render better service.

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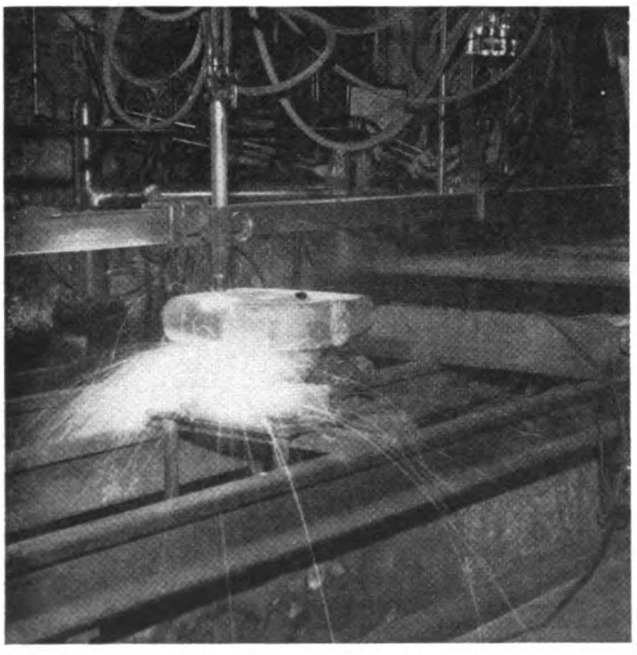
Fixture for holding the service portion of air-brake valves at the Bloomington, Ill., shops of the Gulf, Mobile & Ohio. The fixture pivots about either the vertical or the horizontal axis and secures he service portion with only one clamp. A similar fixture is used for the emergency portion. Both are made from scrap ¼-in. plate and angle iron

Beveling Circular Plates

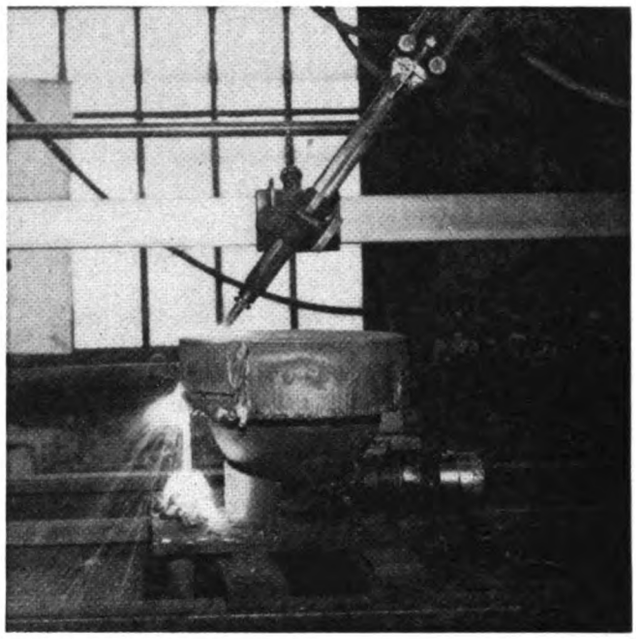


The apparatus for bevel-cutting a circular plate. The motor has an infinitely variable speed control to give surface cutting speeds from zero to 32 in. per min.

Bevels of any angle may be torch cut with a device developed at the Bloomington, Ill., shops of the Gulf, Mobile & Ohio. The device, attached to a conventional shape-cutting machine, was formerly used for flame hardening.



The first step in cutting a beveled circular plate is to cut out the circle with straight walls

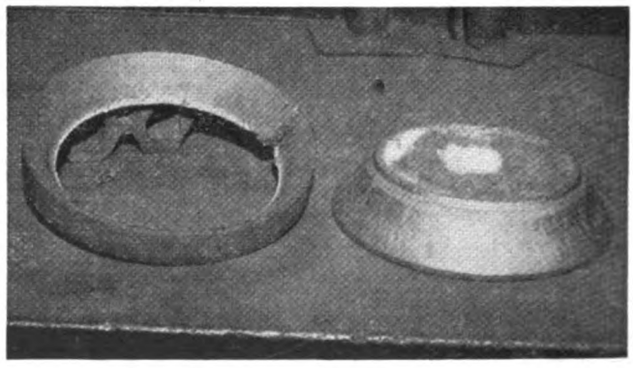


In cutting the bevel segments from the outer ring are cut off about six times with a hand torch and removed with tongs to prevent heavy sections falling and damaging the turning mechanism

It consists of a revolving table, worm-gear-driven by a ⅛-hp. rheostat-controlled variable-speed motor, and an adjustable torch mounting marked off in degrees.

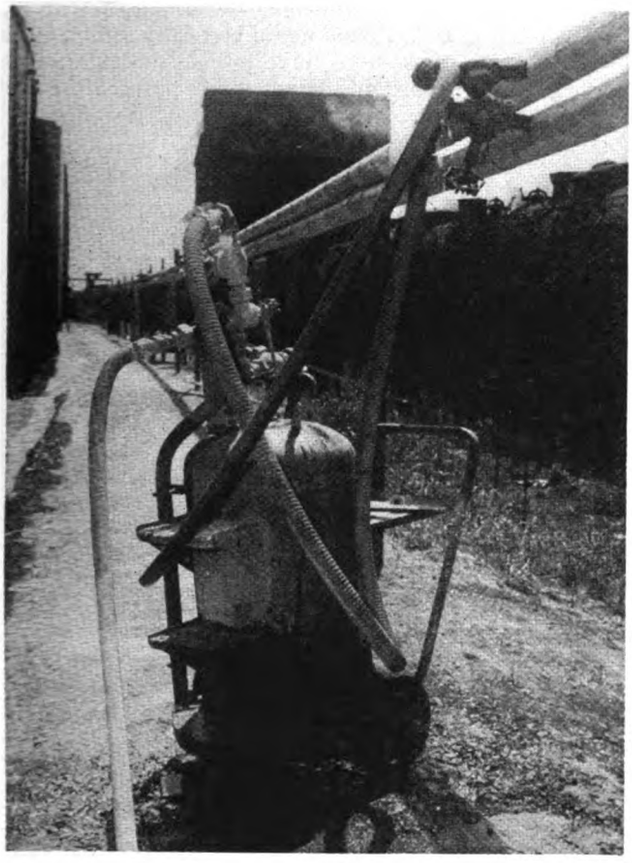
The first step in beveling a circular plate is to turn the plate round with straight walls. During this process the segments beyond the circle are burned off about six times to prevent the falling of heavy pieces which would jar the drive and throw the mechanism out of line. The segments are removed with tongs. If large sections are to be beveled the plate is pre-heated up to 700 deg. F.

After the plate has been cut with straight walls a small groove is burned by hand to where the torch will start when set at the bevel angle. The motor is then switched on to revolve the plate and cut it to the desired bevel. The bevel may be made either for the entire thickness of the plate or for a partial thickness, leaving a straight section above or below the bevel. Two different bevels may also be made on the same plate. A bevel may also be placed on the section hollowed out. In this case the starting groove is hand cut from the inside out.

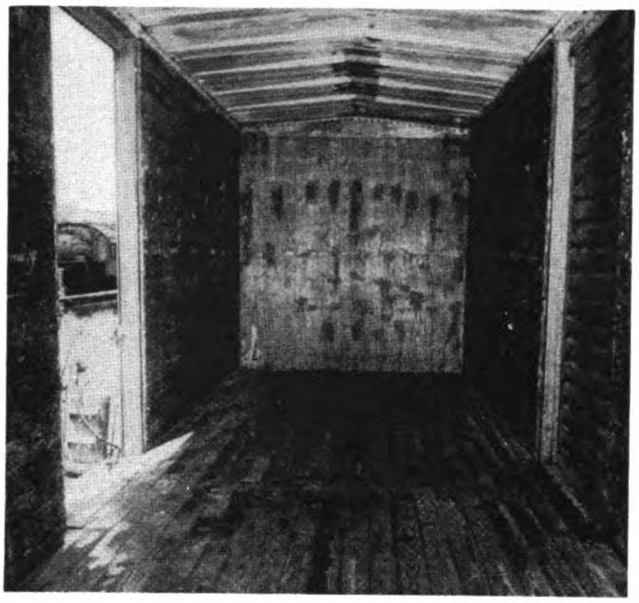


The finished beveled circular plate. If desired, concave bevel can be cut on a continuous-surface ring by slightly altering the procedure

Box-Car Laundry Track



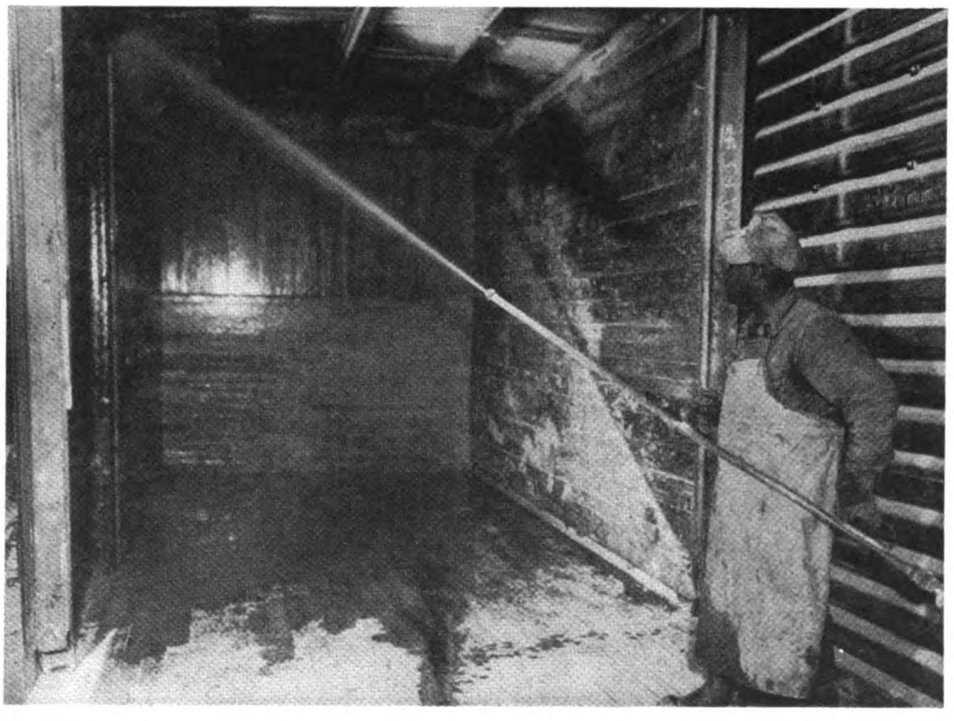
The portable tank from which the box-car cleaning compound is delivered to the nozzle. The steam and water lines which feed this tank are on the right



A car after cleaning on the Southern's box-car laundry

The Southern has completed a laundry track installation at Spencer, N. C., with which five men thoroughly clean an average of 40 or more box cars a day. The laundry track is part of the running repair track for easy switching, and is long enough to hold 20 cars at one spotting. It is laid on a level grade with one rail 2 in. lower than the other for draining the cleaning solution from the interior of the car out through the door opening.

The cars are cleaned after inspection and necessary repairs have been given. Twenty are spotted at one time



The car is cleaned with an injector nozzle on a 7-ft. handle to get in all the corners

with a switching locomotive and left coupled together during the cleaning operations and subsequent switching.

An air line of 1¼-in. pipe is mounted on the ends of the ties along one side of the track for blowing out loose dirt and refuse. The water and steam lines are 1¼ in. in diameter and are supported 6 ft. above the ground on 3-in. pipes. Both are made of welded 2-in. scrap flues. The air line carries 80-lb. pressure and the steam line 125-lb. pressure.

Steam is generated by a diesel locomotive steam generator, which was chosen for this service because it kicks off automatically when not in use, requires no attendant and has no standby fuel loss. The steam generator delivers its output into a reservoir drum at 150 p.s.i. The outlet of this drum has a regulator set at 125 p.s.i. This arrangement delivers a constant flow of steam at a constant pressure.

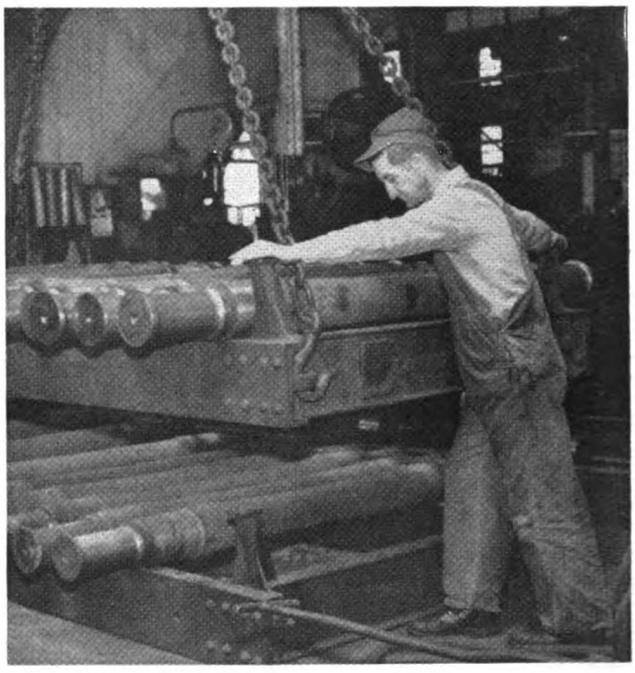
Cleaning is done with a mixture of Pennsalt 45 X, using six ounces per gallon of water. To this is added a mixture of 2½ lb. of Orvis paste for each 50 gal. of water. The compounds are mixed in a 300-gal. main storage tank. The resulting mixture is delivered to portable two-wheel rubber-tired service tanks that move on a concrete runway on the low side of the track. The cleaning compound is dispensed to the car through a 1¼-in. Sellers injector connected to the exit end of the hose that leads out from the tank.

The handle which contains the nozzle is 7 ft. long to permit the workmen to get in all corners of the car. Rubber connection hoses are 1½ in. for the water and 1-in. for the steam. Cars which require deodorizing after cleaning are hand sprayed with Oakite Transamite.

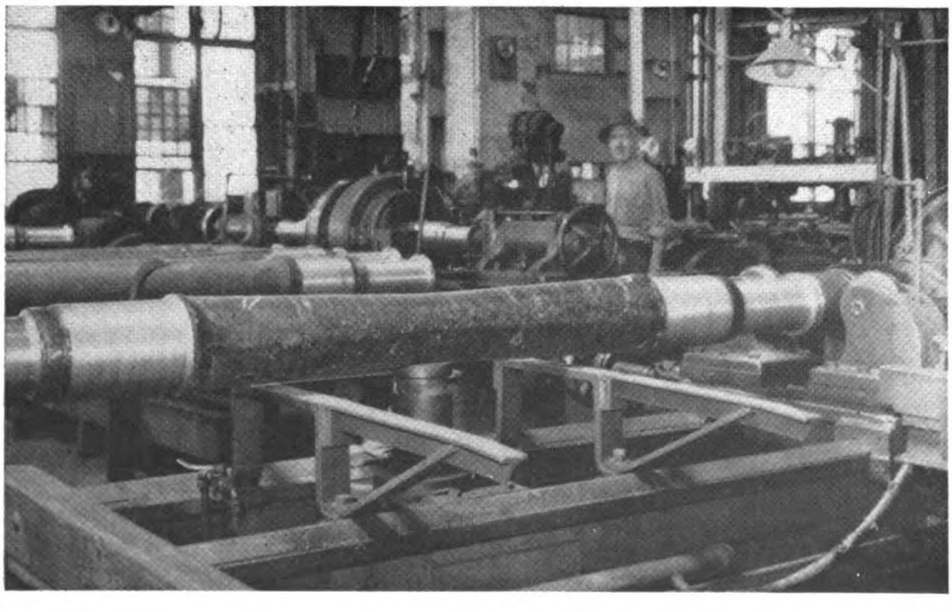
Handling Axles During Reconditioning

The Battle Creek, Mich., shops of the Grand Trunk Western has incorporated several useful material-handling devices in the axle-reconditioning production line. After the wheels have been pressed off, the axle is placed on a rack from which it is fed to the lathe by a jib crane. Leaving the lathe the axle is placed upon a ramp which is equipped with a transfer mechanism at the discharge end.

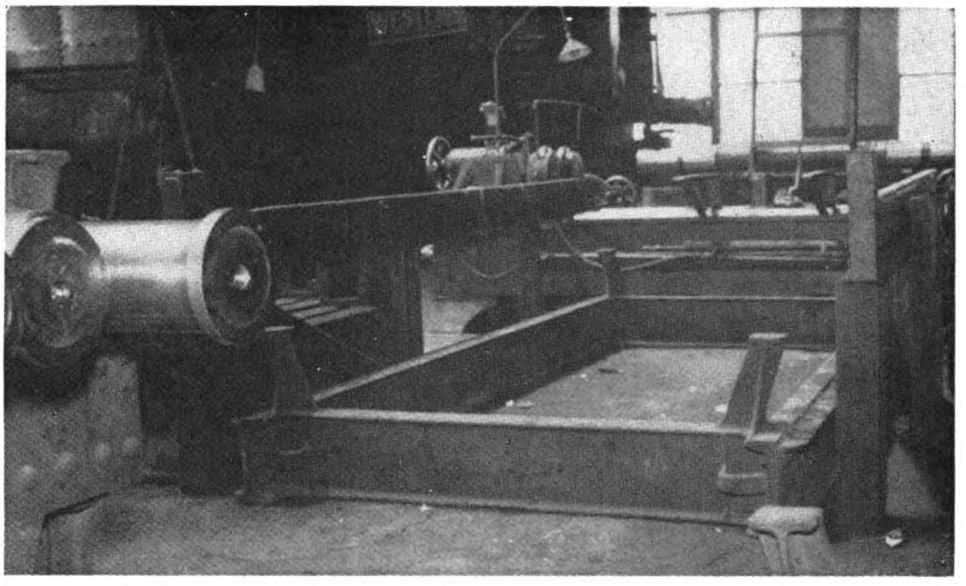
The transfer mechanism comprises a pair of arms that pivot between a horizontal and a vertical position. In the vertical position the arms serve to hold the axles on the feeder rack in place. In the horizontal position the arms serve as extensions of the rails of the rack. Lowering to the horizontal position is done by an air cylinder, which operation automatically transfers one axle from the rack to the extension arms. From the extension arms the axle rolls onto a pair of fixed rails on the burnishing machine.



The portable racks hold up to 16 axles and can be stacked up to eight high



The transfer mechanism for loading axles on the burnishing machine. The axle is loaded on the burnishing machine rack by a pair of pivoting arms from the ramp in the background and is raised to position for engaging the machine centers by the small air jack



The portable rack for handling and storing axles. With the axles resting on the permanent rack, a chain suspended from a crane is hooked to the four corners of the portable rack. As the portable rack is lifted it engages the bottom surfaces of the axles and holds them securely in place by the corner bosses

These rails place the axle a little below the centers of the burnishing machine. The axle is raised for engagement with the centers by a small air jack located between the two rails.

When burnishing is completed the axle rolls off the burnishing-machine rails onto a permanent rack that holds 16 axles. The axles are removed from the permanent rack for storage with a portable rack that holds the same number of axles as the permanent rack. The portable rack serves two purposes. It fits between the rails of the permanent rack and loads the axles onto itself automatically by contacting the bottom edges of the axles as it is raised by the crane through the rails of the permanent rack on which the axles are resting. The chain of the crane hooks to special brackets on the outside of the portable rack to permit picking the axles up as it is being raised.

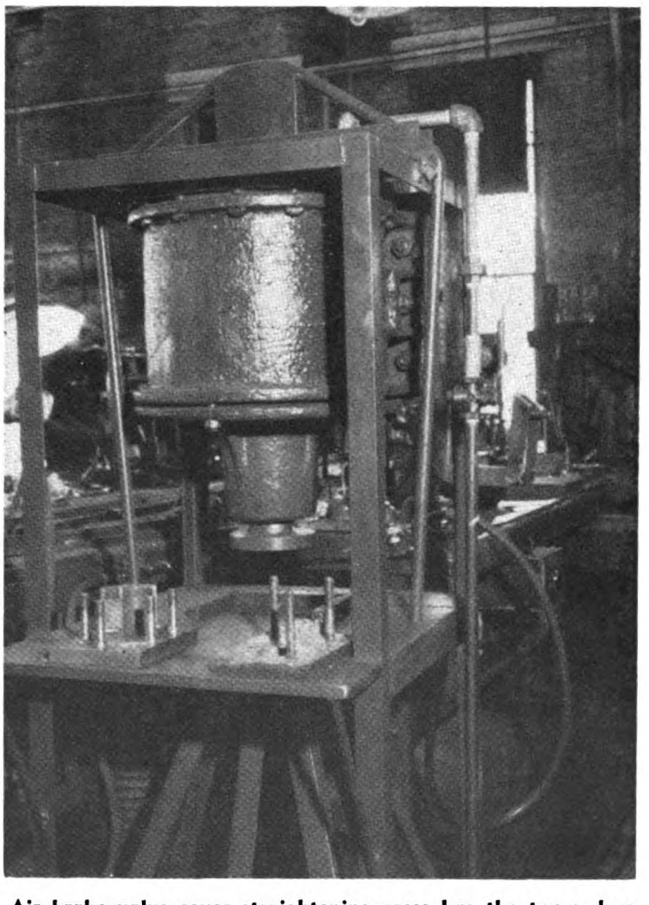
The second function of the portable rack is to store a sizable number of axles in a small space, for which purpose bosses are welded on the four corners. The bosses permit stacking the racks, either empty or loaded, up to eight high with a shop crane, until the axles are called for by the wheel shop.

Extra-Safe Air Brake Cover Press

A cover straightening press for air brake valves has been built at the Bloomington, Ill. shops of the Gulf, Mobile & Ohio in which the possibilities of injury are virtually eliminated. This is accomplished by locating the two valves which are necessary for operating the press along one side so that both hands must be used to operate the press. In this way a man's fingers must be out of the way during the down stroke.

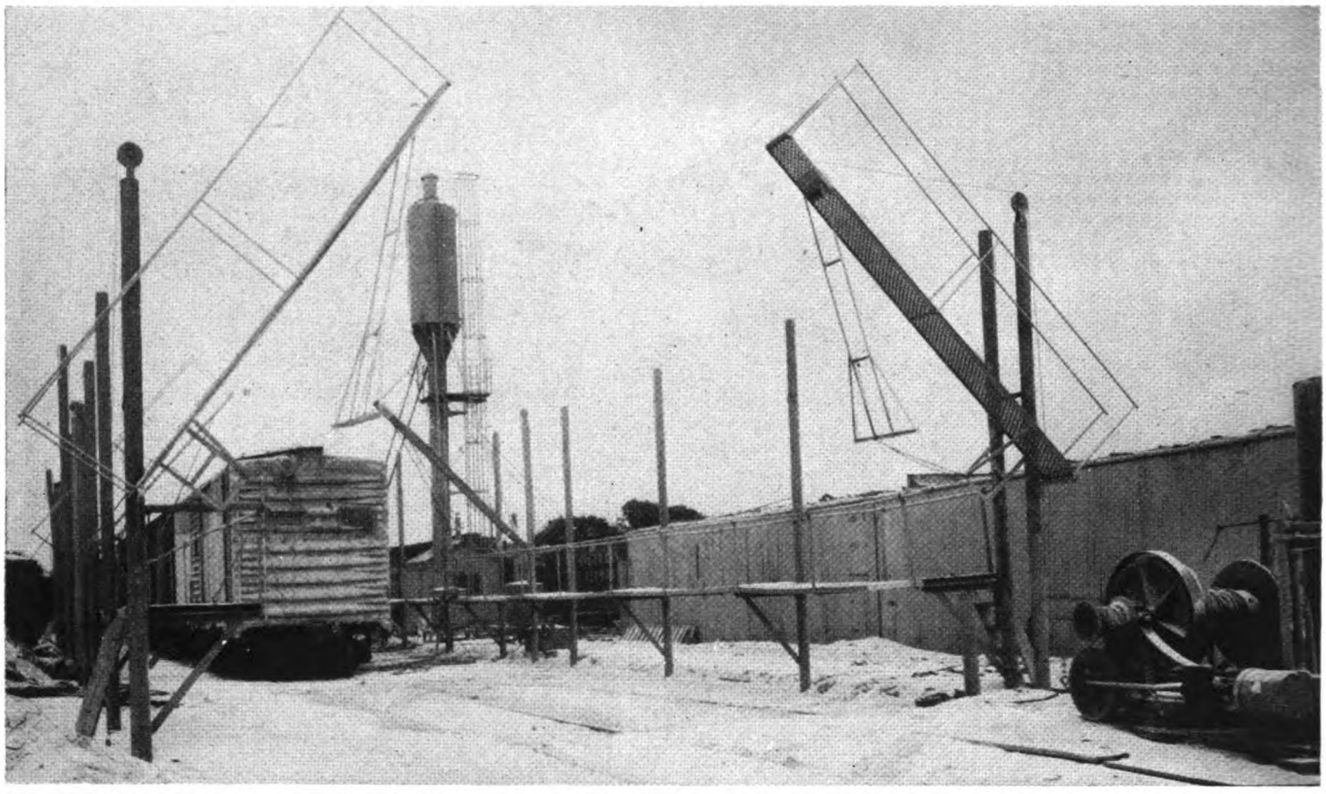
A second modification to the usual type of press for this type of work permits shortening the table. A tension rod ¾ in. in diameter over the top center of the cylinder permits shortening the table by eliminating the need for any struts.

The straightening press is a shop-made device in which the member providing the pressure is a 14-in. by 12-in. air cylinder mounted in a structural steel frame built of angles welded at the corners. The bed of the press is a 1⅛-in. steel plate and mounted on the bed are positioners for locating the air brake valve covers.



Air brake valve cover straightening press has the two valves necessary for operation located on the right side near the back so that the workman must have both hands clear during operation—The tension rod across the top center of the cylinder permits shortening the table by eliminating the need for struts

Layout for Sand-Blasting Cars



The sandblasting area from the exit end with the end scaffolding in the raised position for movement of cars by the winch at the right

A description of the shop facilities used by the Southern at Spencer, N. C., for sandblasting preparatory to painting

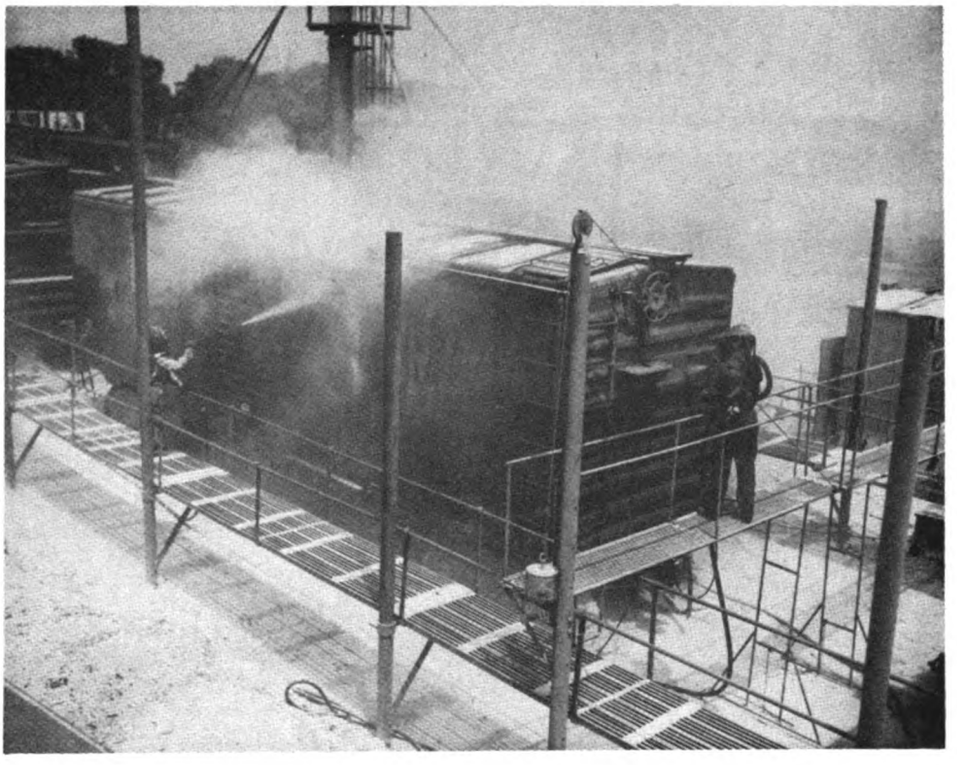
THE area for sandblasting freight cars at the Spencer, N. C., shops of the Southern has one section for cleaning the lower half of the car completely free from obstruction and a second equipped with scaffolding for sandblasting the upper half of the cars. The sandblasting area proper holds four cars, two in the area for the bottom half and two in the area for the top half. The scaffolding for the top half extends for 100 ft. so that with two cars in the area there is sufficient space for cleaning all four ends. The service track, which holds eight cars, is on a 0.6 per cent descending grade to feed the cleaning area. The inclined track extends through the area for sandblasting lower half of the cars and into the scaffolded area. A concrete platform 10 ft. wide is laid along the sandblasting area for a distance of 210 ft.

The cars are rolled into the sandblasting area and spotted by a winch at the exit end. The bottom half of the car is cleaned first in the unobstructed area, after which it is moved to the scaflolded area by the winch for cleaning the top half. Two types of scaffolding are installed to handle the sides and the ends.

The side platforms are 36 in. wide, 4½ ft. above the ground, and are located 5½ ft. from the edge of the car. They are made of lattice wood with sections ⅞ in. by 2½ in. joined by bolts. Guard rails of ¾-in. pipe are mounted 3 ft. above the platforms. Supports for the guard rail are strap iron sections ⅝ in. by 2 in. which bolt to the bottoms of the platfroms.

The three end platforms swing in a vertical arc to permit the passage of cars into and out of the area. These platforms are chained in the clear position for safety and are counterbalanced for easy movement by a weight on a pulley. When in working position they are 7½ ft. above the ground. Construction is of box car running board material stiffened by angle iron ¼ in. by 1½ in. running lengthwise. The guard rails and the guard rail supports are ¾-in. pipe, with the rails 3 ft. above the platforms. The supports on which the ends of the end platforms rest when in working position are hinged to the platforms. They are built up from sections of ¾-in. pipe joined together along the bottom by angle iron members ¼ in. by 1¼ in. by 48 in. which are used to provide additional bracing for the supports.

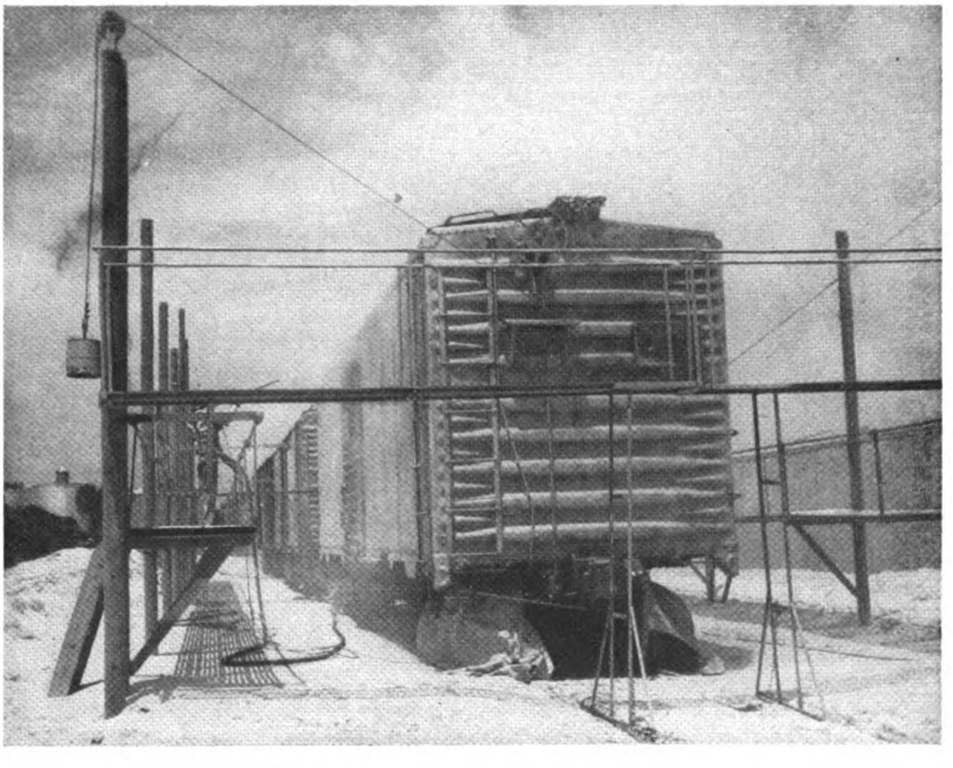
Uprights for the scaffolding are 5-in. flues. Eight are used for each side platform and two for each of the three end platforms.



The top half of both the sides and ends of the cars are sand-blasted easily and safely from the scaffolding

Sand is stored in a 10-cu. yd. tank at ground level, from which it is delivered by air pressure into a second 10-cu. yd. tank 30 ft. above the ground. It flows by gravity to four service tanks, each of which hold 1¼ cu. yd. Sandblasting is done with a 1-in. hose at 100 to 110 p.s.i. pressure with both the air and the sand in the same hose between the 1¼-cu. yd. tank and the delivery nozzle. One air control is installed for each two sandblast nozzles.

For added comfort to the workman a pressure-reducing valve has been installed which cuts the air pressure to 4 p.s.i. for ventilating the helmet. During hot weather this ventilating air is cooled by being passed through an ice box containing 100 lb. of ice.



The end scaffolding showing the hinged supports and the counterweight

ELECTRICAL SECTION

Resistance-Lead Motors For A.C. Multiple-Unit Cars*

By H. G. Jungk†

A NEW m.u. car motor, designed and built for the Pennsylvania electrification, is the Type 431-A, single-phase, series motor with a shunted interpole, no compensating winding and with resistance leads in the armature winding. This motor has a continuous rating of 225 hp. at 328 volts, and 760 amp. at 1,270 r.p.m. The top sustained running speed is 2,800 r.p.m. The corresponding car speeds are 41.3 and 91.1 m.p.h., respectively, with 36-in. wheels and a $^{17}/_{56}$-2 d.p. gear ratio. The average accelerating tractive force of the car (two motors) is 7,000 lb. at 1,050 amp. per armature.

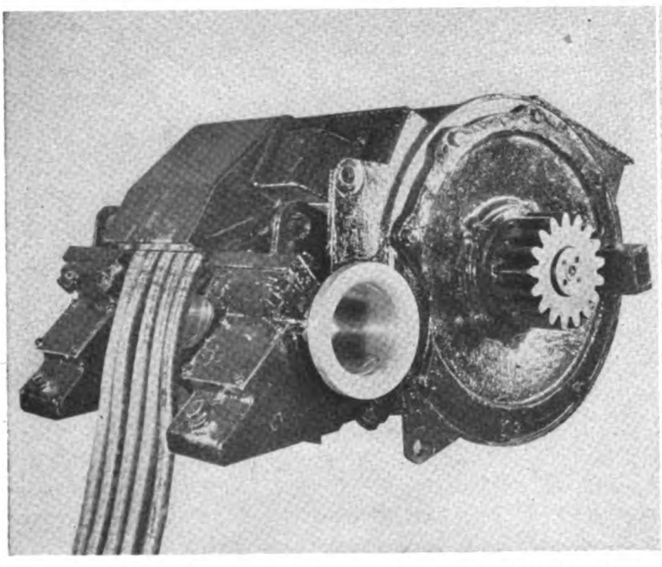
This armature has 8 poles and 8 brushholders, with 3 brushes each of $^{3}/_{8}$-in. x $2^{3}/_{8}$-in. x $2^{1}/_{2}$ in. long electrographitic carbon. The ventilating air enters the air-intake at the rear or pinion end of the frame and is forced through 3 parallel paths to the front or commutator end where all of the air is baffled to pass down over the commutator and brushholders and out through the front housing.

These new motors are smaller than the 412-D and 426-AA types now in operation on Pennsylvania m.u. cars, and have smaller pinions and gear center distance but the frames are designed to fit in the same trucks with the same size axle bearings and the same nose-suspension details as on the present cars. As a result, the frames, housings, axle bearings, axle caps and other stator parts weigh about as much as on the corresponding 426-A motors with fabricated frames, but less than those of the 412-D motors with cast steel frames. The armatures, operating at twice the speed of the 412-D armatures, are much lighter.

Comparison of Motor Weights

Type	412-D	426-A	431-A
Weight, lb.:			
Motor complete with gear case, axle bearings and axle caps ..	6,490	5,938	5,344
Pinion	135	116	61
Total	6,625	6,054	5,405
Armature	2,350	2,230	1,615

The 431-A motors are geared to give the same starting and accelerating tractive forces per car as the 412-D motors, but will operate up to 90 m.p.h. as a sustained running speed while the 412-D's are limited to 70 m.p.h. and the 426-A's to 80 m.p.h. top speed. Although intended for the lighter MP-54 cars, the 431-A motors



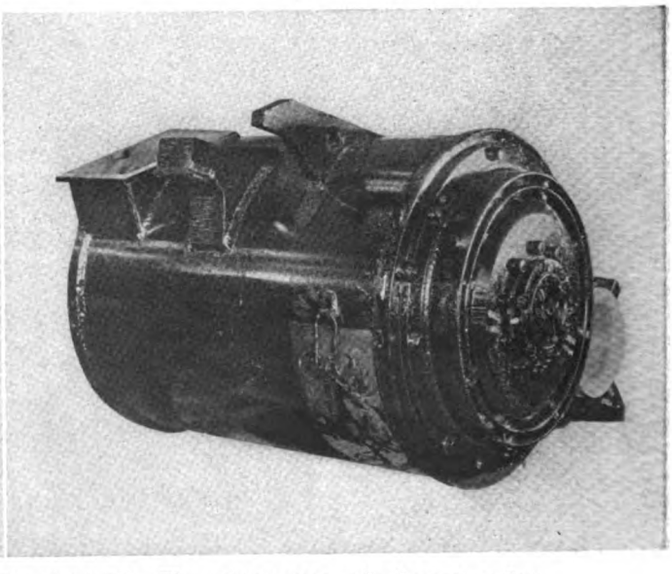


Fig. 1 (left)—Pinion end of Type 431-A motor. Fig. 2 (right)—The commutator end of same motor

* Abstract of a paper presented at the Winter General Meeting of the American Institute of Electrical Engineers, held in New York, January 22-26, 1951.

† Section Head, A.C. Railway Motors, Transportation and Generator Engineering Department, Westinghouse Electric Corporation, East Pittsburgh, Pa.

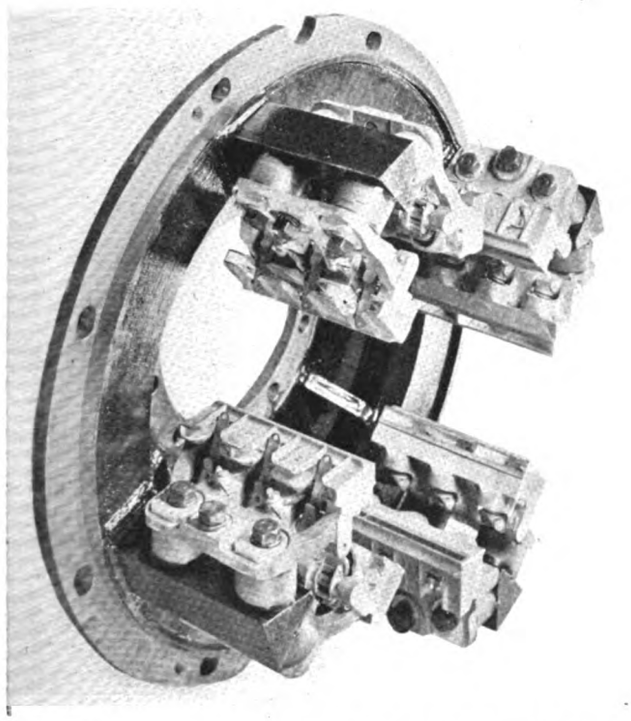


Fig. 3—The commutator end housing of a Type 431-A motor, complete with brushholder supports and brushholders

have the capacity to accelerate the heavier P-70 cars if applied on them.

The two motors on a car are connected in parallel to the transformer rather than in series as is generally done on both a.c. and d.c. motors. This minimizes the tendencies of wheels to spin when a wheel slip occurs.

After a careful study of the experiences over the past 40 years with a.c. multiple-unit car motors of various combinations of resistance leads, interpole fields, compensating windings on doubly-fed, repulsion and series types with high, low and medium flux per pole, the Type 431-A motor was designd with series fields and interpoles in the stator and resistance leads in the armature to give simplicity in both motor and control. The mechanical and electrical parts are substantially built and with sufficient margin in rating to insure low maintenance cost.

A number of features, incorporated in the design to eliminate some of the troubles experienced in the past, and to simplify maintenance, are applicable to any motor while others are possible only with the resistance-lead design.

General Improvements

The features adaptable to any design and their importance in reduced cost and maintenance are briefly as follows:

Rear End Ventilation—Many of the insulation failures on commutator motors are developed by introducing ventilating air at the commutator end. Overheating of front end ventilated 426 motors has been caused by improperly fitted commutator covers and resultant air leakage. On the 431-A motor, ventilating air is introduced at the rear or pinion end, so that carbon dust from brush wear is blown out of the motor, instead of into the windings. This materially reduces the possibility of accumulation of dirt on exposed creepage surfaces. It also has the advantage that if the commutator covers do not fit tightly, or if they fall open or drop off, ventilation will not be affected.

Pre-Insulated Armature Coils—To reduce grounds and shorts which now occur with the threaded-in-fold-over straps used on the more recent motors, open armature slots are used so that the coils may be pre-insulated and baked before winding into the slots. The coils are still constructed from two half-coils connected at both ends after winding so as to retain the advantages of winding and ease of repairing such windings.

Pre-Insulated Stator Coils—To improve the insulation of stator coils, and to reduce coil lead breaking, the exciting field coils are formed, pre-insulated and baked before winding into open slots. The coils are connected, all in series, to carry full line current and thus the conductors are of substantial cross section and strength. The interpole coils, like those on d.c. motors, are completely wound, insulated and baked before winding over the interpole, making the construction simple and rugged.

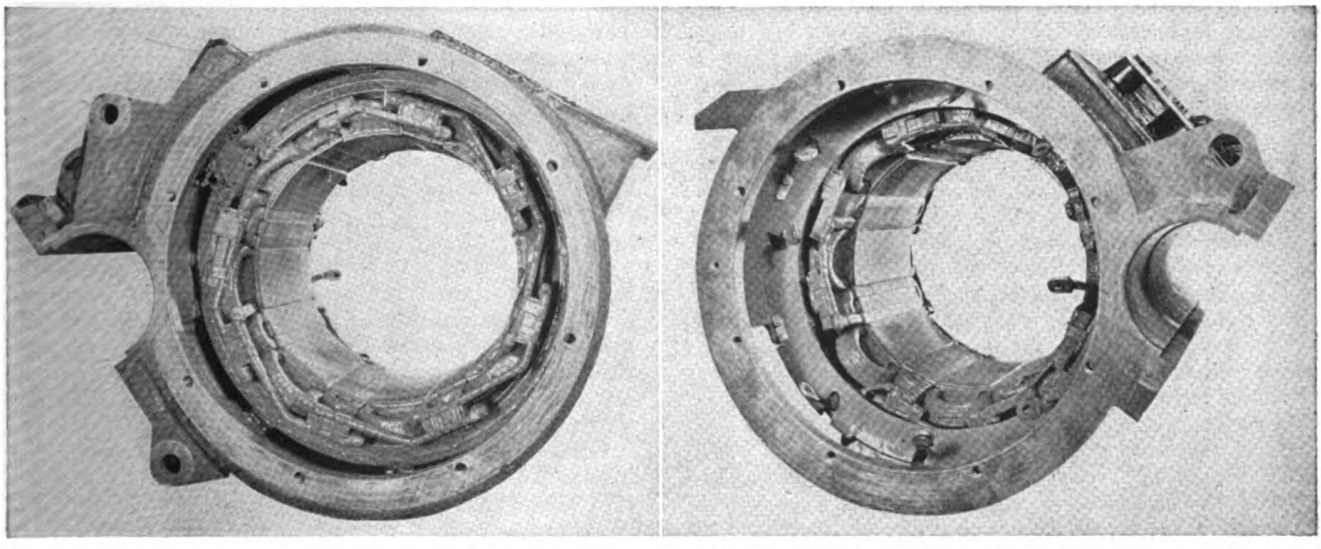
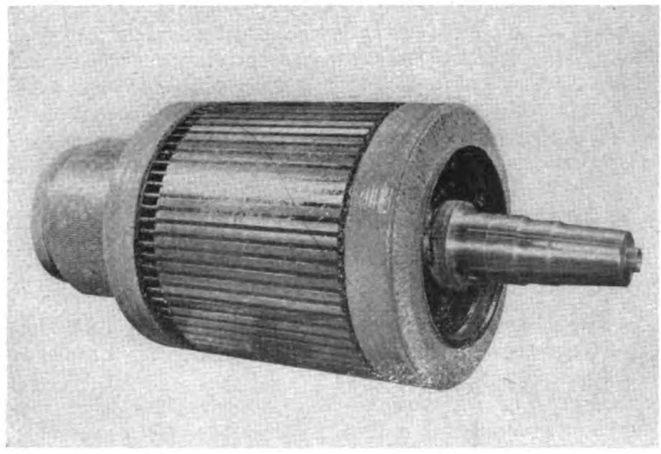


Fig. 4 (left)—The wound stator of a Type 431-A motor as seen from the pinion end. Fig. 5 (right)—Wound stator of the same motor as seen from the commutator end



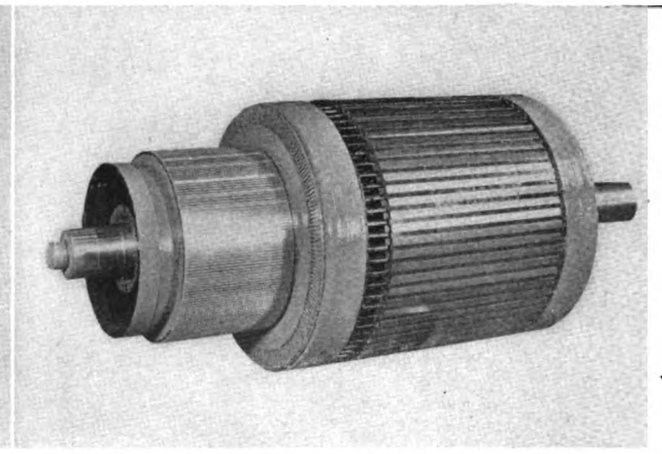


Fig. 6 (left)—The pinion end of the armature of a Type 431-A motor. Fig. 7 (right)—The commutator end of the armature of the same motor

Brushholder Support — Commutator motors usually have brushholders mounted in the frame and any repairs, replacements or neutral adjustment tie up a complete motor. The 431-A motor brushholder supporting arms are mounted on the housing thus providing for quick removal and replacement in case of trouble. This unit of housing and supports with brushholders can be repaired at the bench and location of holders checked and held on neutral.

Resistance-Lead Design Developments

The features applicable only to a resistance-lead design and their importance in reduced cost and maintenance are as follows:

Less Commutator Heating—Overheating of commutators, with resulting flat spots causing high commutator maintenance and brush breakage, has been one of the most elusive troubles with the commutator type motors in locomotive service. The resistance lead design reduces commutator heating. The resistance leads carry current only when the corresponding commutator bars are under a brush. Since this occurs in any one lead only 10 per cent to 12 per cent of the time, the resistance of the lead can be made high enough to substaintially limit circulating current in the brush face and armature circuit at standstill, and at low speed and high tractive force where the interpole has no effect because of zero or very low speed. Since the total brush loss and resistance loss in the windings is practically the same per hp., regardless of poles and windings, part of this commutation loss can be absorbed in the resistance leads around the armature, thus relieving local heating on the commutator surface and brushes.

Higher Flux per Pole at Start—The circulating currents in the brush face are set up by voltage induced in the armature coils by the alternating flux per pole. Since the circulating currents can be held to safe values by resistance leads, the exciting flux per pole at start, and for heavy currents on the 431-A motor was increased to almost twice that permissible on a motor with no resistance leads. Hence, it is not necessary to shunt the exciting field at start.

Higher Motor Voltage and Lower Current — Increasing the flux per pole increases the line voltage and lowers the line current and number of poles accordingly. Hence, the required starting tractive force of 7,000 lb. per car is obtained with only eight poles at 1,050 amp. A conventional motor without resistance leads geared for the same commutator peripheral speed would require 1,800 amp. and 12 poles for the starting tractive force.

Less Current in Cab Wiring—The lower current results in reduction in the size of the transformer low voltage terminals and the size of the car cable in the ratio of 720 to 1,120 or by 64 per cent, and in the current rating of the main circuit control apparatus.

Fewer Active Motor Parts—With a higher voltage and lower line current for eight poles, only 24 brushes are required and eight brushholders. Likewise, eight exciting field and interpole windings and only 204 commutator bars, reduces the weight, first cost and maintenance cost.

Less Armature Weight — The 204-bar commutator is only 12¼ in. in diameter and can run at 2,800 r.p.m. with 9,000 ft. per min. peripheral speed to give a car speed of 90 m.p.h. with 36-in. wheels. The lighter, high speed motor requires smaller shaft, roller bearings and pinion all of which reduces weight and cost.

One Interpole Shunt Setting — Resistance leads absorb some of the higher frequency commutating currents and sparking. The interpole excited with 25-cycle current will only compensate for 25-cycle commutation but the resistance leads will compensate at any frequency. This means less sparking at the higher speeds and currents as well as at start where resistance leads are used. As a result only one interpole shunt setting is required and control is simplified.

Low Brush Current Density — High voltage and low line current make it possible to keep brush density at lower values, 67 amp. per sq. in. at continuous rating and 98 amp. per sq. in. at starting (7,000 lb. tractive force per car).

No Breakage of Commutator Risers — Many failures have occurred in the past few years on armatures due to broken commutator risers. Armature coils are connected to the resistance leads and not to the commutator risers thus reducing the possibility of this breakage and also of burning behind necks, at the same time facilitating armature repairs if a failure should occur.

Equalization of Current to Brushholder — The introduction of resistance leads equalizes the division of load current between brushholders. On any full multiple wound armatures, there are as many parallel circuits as introduction of resistance leads equalizes the division of

(*Continued on page 73*)

Why Four-Motor Multiple-Unit Car Equipment*

New a.c. and d.c. motors and control with all, rather than half of car weight on drivers, benefit both the passenger and the railroad

By R. A. Williamson†

In 1949, steam railroad commuter traffic was crowding the 6.6 billion passenger mile record of 1926, in spite of the inroads of private automobiles. There is an increasing urge for the large city breadwinner to live farther and farther from his work, yet experience has demonstrated the utter impossibility of ever providing enough parking and highway facilities for his private automobile. Obviously then, the business of transporting him by means of large, efficient units off the public highways is bound to become more and more rather than less and less important. This type of facility is best provided by our large railroads through their suburban service in metropolitan areas. The fact that they recognize their opportunity and responsibility and intend to meet them is shown by increasing activity all along the line. The Reading, Pennsylvania and New York Central roads whose commuter territory is electrified, have recently added to, or commenced modernizing, their fleets of electric multiple-unit cars. Non-electrified roads are experimenting with light-weight, high-capacity coaches handled by diesel-electric locomotives.

Acquisition of such new equipment—which, at least in the case of the New York Central multiple-unit cars, will not even train with hundreds of older units—is one more indication of the willingness of the railroads to cut loose from the past and face the future with the recognition that 1960 times cannot be served with 1916 machinery.

Various studies (See reference 1) have shown that electric multiple-unit cars are the best means for handling suburban passengers on those roads where volume of traffic justifies electrification. They have also tended to show that, where technically possible, all-motor-car trains are preferable to motor car-trailer car combinations. Railroads currently concerned with modernizing their multiple-unit car services are apparently confirming this view by their interest in trains consisting of motor cars only. The purpose of this paper is to go further and show particularly how trains having not only all cars motored but all axles motored, readily dispose of today's problems and anticipate tomorrow's needs as well.

Nature of Requirements

Passengers want fast, comfortable, dependable low-cost service. The railroads need equipment which will fulfill the following requirements:

(a) Improve public relations through more attractive facilities and better service.

(b) Increase return on investment through greater usefulness and availability of equipment.

(c) Save money by reduced wear and tear on parts, by less need for attention, and by increased convenience of maintenance operations.

(d) Stay young and up-to-date.

Fast schedules in frequent-stop service require high accelerating and braking rates. At the same time, reasonably high top speeds are needed for express and semi-express runs, since a large suburban operation is a composite of both. Fortunately, as the commuting radius expands, it is more convenient to supply semi-express or skip-stop service. This tends to favor one design of equipment geared for all services.

The maximum practical accelerating rate for a train of two-motor cars, with 55 per cent weight on drivers, is 1.5 m.p.h. per sec. At this rate, the maximum adhesion on the driving axle which unloads because of weight transfer, reaches about 18.4 per cent. With every axle motored, 2.0 m.p.h. per sec. can be obtained with a peak adhesion of only 12.9 per cent. Even higher rates are practical; 2.5 being a modern subway standard, and 3 or 4 m.p.h. per sec. being obtained by P.C.C. cars every day on city streets, where rail conditions are by no means favorable.

High braking rates can be obtained by conventional methods without exceeding practical adhesion values, but the added wheel and shoe duty, plus the complicated mechanisms required to protect against excessive damage in case of wheel sliding become very burdensome. Trains with every axle motored are ideally suited for the use of dynamic braking, with a 2.0 m.p.h. per sec. decelerating rate, producing a peak adhesion of about 11.1 per cent and a 2.5 mile rate 14.3 per cent. Dynamic braking with only 55 per cent of the train weight on drivers (i.e., with two-motor cars) is not very attractive or practical, even the low rate of 1.5 m.p.h. per sec., producing an adhesion of nearly 16 per cent.

Adaptability of Four-Motor Equipment

Only modern equipment with every axle motored serves all the above needs best. Furthermore, better advantage can be taken of technical progress in reducing the weight of cars and equipment. Such weight reductions release motor capacity for other than purely weight hauling purposes. Trains with all axles driving can use this re-

* Abstract of a paper presented at the Winter General Meeting of the American Institute of Electrical Engineers held in New York, January 22-26, 1951.

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leased motor capacity to produce extra performance without exceeding workable adhesion limits. This would be impossible with two-motor equipments, whose performance is already pretty definitely limited by adhesion.

Distributing motor capacity over all axles instead of concentrating it on half the number, or less, permits using space which would otherwise be wasted to secure important high-quality design features. Truck-mounted, instead of axle-hung, motors greatly reduce unsprung axle loading. Better riding qualities and reduced wear and tear on both motor and truck parts result from the corresponding reduction in road shock. Self-contained gear units are semi-permanently axle-mounted in roller bearings. This completely eliminates friction bearings and the annoyance of gearing trouble caused by misalignment. Oil bath lubrication of gearing insures long, quiet, dependable operation. Smaller and lighter parts, and the possibility of dismounting either motor or gear unit without disturbing the other, facilitate handling and spell reduced expense. For example, the motor armature of the new four-motor a.c. equipment for the Pennsylvania weighs only 680 lb., compared to 1,880 for a comparable two-motor armature, and the motor itself weighs only 1,875 lb. instead of 5,000. Imagine what this can mean personnel- and facility-wise.

Equipment of this general type has demonstrated its ability to operate for years in difficult service with one-

TABLE I—WEIGHTS OF EQUIPMENT

	New York Central 650-volt d.c. 75-ton car 1.5 m.p.h. per sec. acceleration (no dynamic brake) 70 m.p.h. maximum		Pennsylvania 11,000-volt, 25-cycle a.c. 68-ton car 1.0 m.p.h. per sec. acceleration (no dynamic brake) 85 m.p.h. maximum	
	4 Motors	2 Motors	4 Motors	2 Motors
Motor weight, lb.	10,700	10,400	11,584	12,240
Control weight, lb.	4,500	4,500	12,716	15,060
	15,200 (1)*	14,900	24,300 (2)*	27,300

*(1) Motors good for 2.0 m.p.h. per sec. dynamic braking with some reduction in car weight.
*(2) Motors good for 2.0 m.p.h. per sec. dynamic braking.

half to one-third the frequency of inspection required for older conventional equipment, and at two-thirds the direct inspection cost. No intermediate shopping for attention to equipment is required between overhauls, therefore, greater savings actually accrue because of fewer trips to the shop. Not only is less attention needed, but it is more conveniently given.

Formerly the extra weight and cost of conventional four-motor equipments as compared to two-motor equipments tipped the scales against them. Modern designs and production have now equalized and, in the a.c. case, reversed this situation. Table I shows how the weights of new four-motor equipments recently placed in service by the New York Central (100 cars) and the Pennsylvania (50 cars) compare with those of comparable two-motor equipments.

If reasonable quantities are purchased, the price of four-motor equipments is no higher than that of two-motor equipments.

Many factors, aside from the operational advantages previously described favor the use of four small motors in place of two larger ones. Some of these are:

1. Commutation constants are usually better, for both a.c. and d.c. motors.
2. Windings of both field and armature are simple and the coils are short, minimizing the effects of contraction and expansion so that they stay in good condition longer.
3. Bearings and other parts for the smaller motor cost only about one-fourth to one-half as much as those for the larger one.

The six-pole a.c. design becomes sturdy and simple enough to encourage self-ventilation. With the gear ratio available this is quite practical. It has the advantage of eliminating costly air ducts, flexible connections, external blowers, and the expense of maintaining them.

5. In neither a.c. nor d.c. designs can the motors exceed maximum safe speeds, therefore, no overspeed or

TABLE II—EFFECT OF DYNAMIC BRAKING ON BRAKE-SHOE LIFE

	Without per cent	With per cent
Trolley coach	100	300
Rapid transit train	100	500–1,300 (a)*
Diesel-electric freight locomotives and train (1)†	100	170–310 (b)*
Diesel-electric passenger locomotives and train (2)†	100	300–340 (b)*

*(a) Data obtained from rapid transit industry.
*(b) See reference (2).
†(1) Three 1,350-hp. units hauling 80 car trains.
†(2) Three 2,000-hp. units hauling 13 car trains.

slip protection is necessary. This is a new self-protecting feature in a.c. motors. Many of the conventional motors now in use will run faster on the road than the maximum safe motor speed. This protective feature, brought about partly by the new fan load, considerably simplifies control problems.

6. Existing two-motor a.c. equipments have been judged too slippery to operate except with motors permanently in parallel. This requires the main motor circuits to handle very heavy currents. With accelerating adhesion reduced to one-half and the self-protecting features described, four motors can be run two in series, two groups in parallel, doubling the transformer secondary voltage and halving the current. Thus, the low-voltage low-flux, series motor design can be retained and the reasonable power circuit currents secured at the same time. This motor grouping has made possible a motor-driven, cam-operated main controller—something new to the a.c. car field and an improvement which has been sought for many years.

Dynamic Braking

Dynamic braking seems so inevitably a part of the future development of the suburban multiple-unit car that more should be said about it here. The problem of moving trains is simply a matter of pouring energy in and draining it out. Elaborate, expensive and sturdy machinery has been developed for the "in" process—yet it often is idle 25 per cent of the time the train is in motion. Certainly logic dictates putting this investment to greater use by making it serve the "out" cycle as well. This is accomplished by the addition of only a fraction of the total cost of the propulsion machinery. Against this fraction can be credited direct and secondary gains from reduced maintenance on brake shoes, wheels, brake equipment, etc.

Every transit vehicle whose performance and acceptance have shown notable improvement in the past 20

years has overcome the deceleration obstacle by adapting its propulsion machinery to braking. The trolley car adopted dynamic brakes in 1930, when it shucked off a 30-year-old shell and stepped out as the P.C.C. model. The trolley coach outgrew friction brakes in the middle 1930's and the rapid transit car a little later. After a slow start, primarily as a holding brake for diesel-electric locomotives descending grades alone, the dynamic brake has earned its place on railway locomotives to the extent that at least one large western railroad has applied it to all road locomotives, both freight and passenger, and makes its use mandatory everywhere possible—in level as well as mountainous territory.

TABLE III—APPROXIMATE ENERGY CONSUMPTION OF TRANSPORTATION VEHICLES

	Input watt-hours per ton-mile	Per cent of input dissipated by brakes
Passenger trains (streamliners, average to mountainous territory)	32	15 (a)*
Freight train (average profile)	17.2	18 (a)*
Freight train (mountainous territory)	20	44 (a)*
Trolley coach (level)	237	60
Rapid transit car	82–103	67
Suburban multiple-unit car	100–158	68–72

*(a) Estimated for trains of reference (2)

One of the reasons for this state of affairs is clearly shown in Table II. Obviously such increases in life mean substantial direct dollar savings in material and labor of application, to say nothing of indirect savings due to less handling and better planning. Evidence is available from rapid transit operations showing that wheel life is increased up to 100 per cent, which further adds to direct and indirect savings. It is reasonable to expect that suburban multiple-unit cars would show results substantially in line with those for rapid transit trains.

Not so much is known about the effect of dynamic braking or increased life of wheels on locomotive-hauled trains; but, assuming that overall life and miles between turnings can be increased from 30 to 50 per cent, savings would be at least equal to those obtained from increased brake shoe life.

The need for dynamic braking is directly related to the amount of energy dissipated in the brakes. This depends upon the energy input to vehicles in various services and the per cent of this input appearing at the brakes. Both assume formidable values in high-schedule-speed and/or frequent stop service. Table III shows approximate representative values for these two factors. Technically, among all these vehicles, the suburban multiple-unit car needs dynamic braking most, yet it is the only one not using it. Time will serve only to increasingly accent this need.

Suburban trains having all axles motored and equipped with dynamic braking can furnish smooth, quiet, fast, dependable service. They appear best suited to the future requirements of a public already accustomed to floating power and rubber tires.

Equally important, they offer the railroads just as much as they do their customers:

1. Reasonable first cost.
2. Better utilization and more intensive use of rolling stock through more versatile and dependable equipment.
3. Reduced maintenance expense through higher quality design, i.e., (a) smaller, lighter, less expensive parts; (b) more convenient to handle; less attention required, and easier to give.

References:
(1)—"Handling Suburban Traffic on Steam Railroads"—H. L. Sloman, Westinghouse Electric Corporation, A.I.E.E. Transactions Vol. 67, Part II, pages 1670-74.
(2)—"Advantages of Dynamic Braking"—J. P. Morris, assistant to vice president, Atchison, Topeka & Santa Fe, *Railway Age*, Vol. 127, No. 25, December 17, 1949, page 1087.

Resistance-Load Motors For A.C. M.-U. Cars

(*Continued from page 70*)

load currnet between brushholders. On any full multiple wound armatures, there are as many parallel circuits as there are poles or brushholders. With armature cross connections, the impedance between brushholders is low, especially for current surges and transients. The increase in resistance in paths due to resistance leads will tend to keep the current balanced in all the circuits and pairs of brushholders.

A view of the assembled motor from the pinion end, Fig. 1, shows the pinion, axle bearings, motor-lead cables and junction box, also the air intake just above the frame barrel. In Fig. 2 the nose support, safety nose, commutator covers, air intake at the rear and air outlet openings in the commutator end housing are seen from the commutator end view.

The commutator end housing, Fig. 3, complete with brushholders, forms an assembly which is located on neutral by means of the half-hole in the flange. This half-hole fits around a dowel pin set on neutral and welded in place on the frame flange. The roller bearing cartridge mounts in the bored seat and is held in place by bolts through holes drilled in the housing.

Wiring and connections of the exciting field coils are made at the rear- or pinion-end of the stator as in Fig. 4. Completely pre-insulated and baked, these coils are wound under the main pole tips by a new and novel method of first expanding the coils to pass over the pole tips and then stretching again to bring the coil sides in place against the main pole body. The interpoles have no tips and the sides are parallel. Hence, after the exciting field coils are in place, the interpole coils, pre-insulated and baked, are dropped down over the poles in the usual manner.

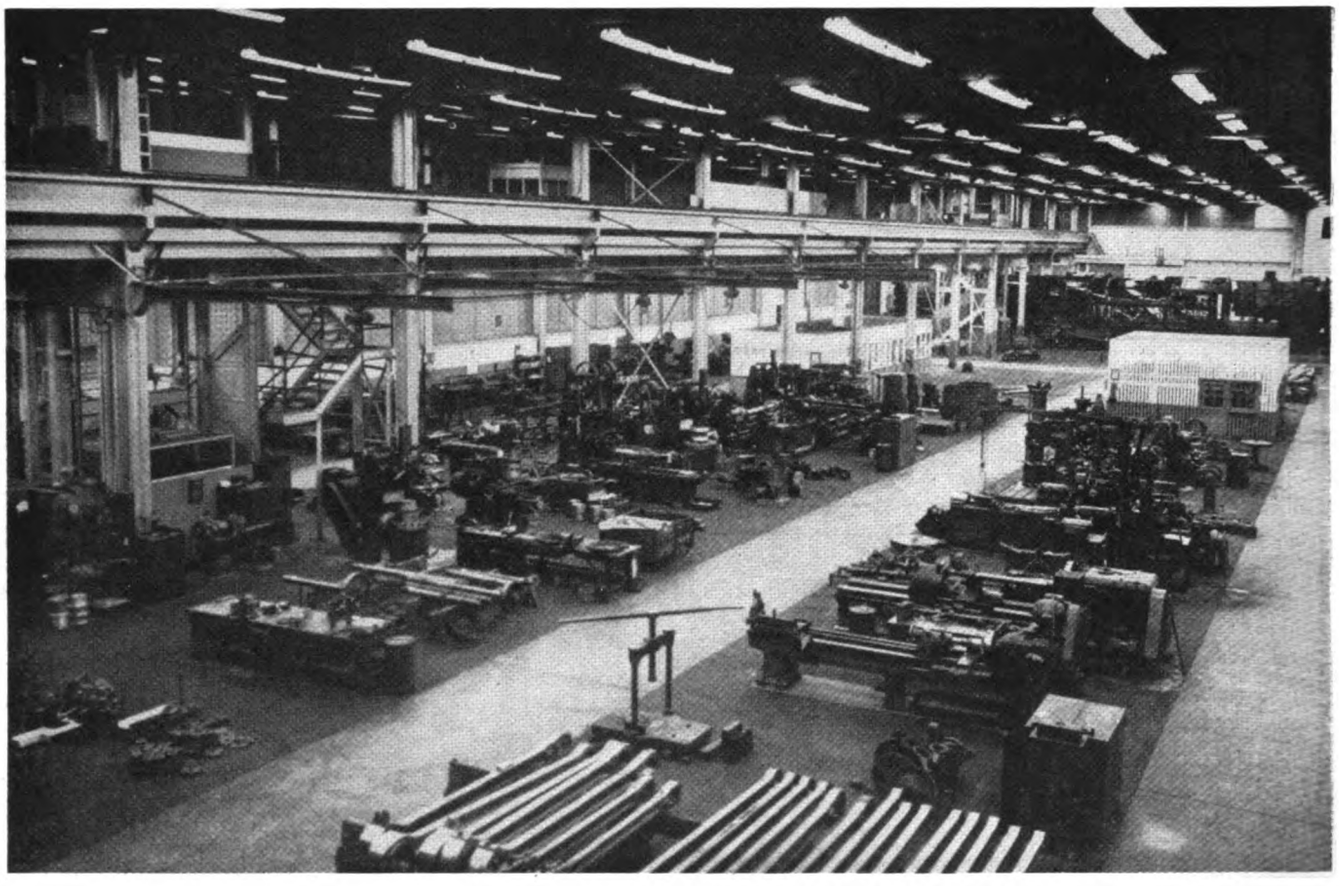
Interpole field connections and leads to brushholders are at the commutator end of the wound stator, Fig. 5. The air-baffle ring, also at this end, directs the air from back of the punchings down over the stator coil ends to the commutator surface. Above the frame, at the terminal board, the flexible straps from the stator wiring are shown bolted to terminal straps. These straps are mounted on insulators, two to a terminal, bolted to the frame plate. The dowel for locating neutral is not in this picture. The bolt hole, by which the dowel is held in place before welding, is between two of the housing bolt holes.

Armature coil ends are connected to resistance leads at the rear end of the armature as in Fig. 6. The ventilating air, entering at the rear, blows down over these connectors and then under the coil support, into axial holes through the armature punchings, and out again at the front end between coils just ahead of the punchings. At the commutator end of the armature, Fig. 7, the resistance leads pass from the bottom of the armature slots to the

risers of the commutator bars, thus connecting the armature coil ends at the rear to the commutator bars at the front end of the armature. The outside cylindrical surface of the risers is insulated with glass and mica and serves as a supporting surface upon which the armature coil ends are banded down in place. This allows the armature coils to expand and contract independent of the commutator risers. The commutator is of the disk spring ring type, designed for high speed operation.

It is not the purpose of this paper to develop a treatise on the theory of design of motors, but rather to point out new features of the 431-A motor, and to describe some of the advantages of this particular combination of design, chosen to produce an m.u. car motor, simple and rugged in structure, in order to give reliable service. The new motor costs less ,and weighs less than previous designs and, at the same time, provides considerable margin in rating. With fewer working parts, and simpler control, greater reliability in service and lower maintenance expense should be realized.

Lighting of Low-Bay Shop Areas



"The descriptive expressions high-bay and low-bay may at times be misleading since the proportions of the room rather than its actual ceiling height usually determine which type of lighting equipment is appropriate. In most instances, "low-bay" should be considered synonymous to "wide-bay."

"From the standpoint of seeing and physical comfort, and often economy of operation as well, fluorescent lighting is certainly recommended as the best general lighting for low-bay industrial areas. The low brightness of the lamps minimizes direct and reflected glare, their extended length softens shadows, and their high efficiency and low heat radiation characteristics make them comfortable to work under.

"The best way to position the luminaries is to mount them so that they are at right angles to the direction that most of the people in the shop face. In this position, the sides of the reflectors provide some protection against direct glare from the lamps. Installations in the 50-foot-candle class are usually laid out in continuous rows.

The foregoing is an excerpt from a 72-page, illustrated publication called "The Lighting of Railroad Properties," written by H. H. Helmbright and M. A. Mortensen, and issued by the Engineering Division, Lamp Department, General Electric Company, Cleveland 12, Ohio. The publication is profusely illustrated and deals both with the fundamentals of illumination and the lighting of specific locations. It describes means of obtaining good lighting in railroad shops, yards and stations, and deals specifically with many details such as the lighting of ticket windows, luminous signs, stairways, drafting rooms, platforms, etc.

CONSULTING DEPARTMENT

Surge Testing of Traction Motor Armatures

Can you tell me how the Westinghouse Electric surge tester for traction motor armatures works, showing a diagram of the circuits involved, and also tell me just what information it gives to the man making the test?

Surge comparison testing of insulation of d.c. traction motors, armatures, field coils, a.c. stators, transformers, and the like, combines all the advantages of previous methods and makes easier interpretation of results. As in other methods, high-frequency voltage is used to keep current through the windings to reasonable amounts while still stressing the insulation to the overvoltages likely to be encountered, from switching surges and lightning.

The main advantage of the new method lies in the way readings are indicated. Wave shapes and amplitudes of the high-frequency voltage impressed on both the winding being tested and that of an adjacent winding are

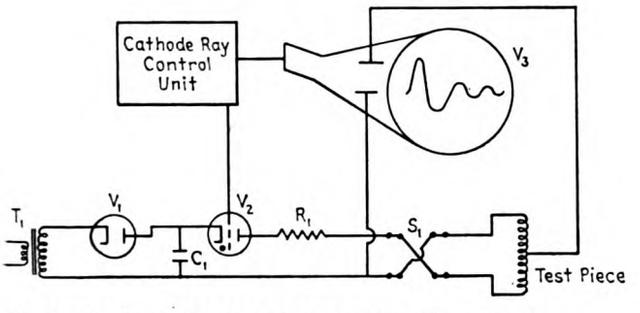


Fig. 1—Basic components of surge comparison tester

Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical and Electrical Engineer, 30 Church Street, New York 7.

What is the best method to use for cleaning up slots in armature iron prior to winding or rewinding? Have you any evidence or information to indicate that improper cleaning may cause excessive core loss or hot spots?

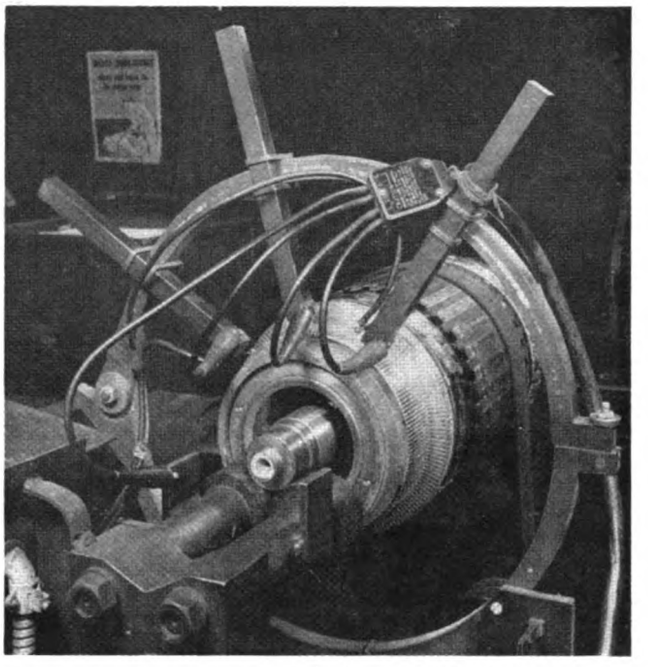


Fig. 2—Lead arrangement and adjustment brush rigging over commutator

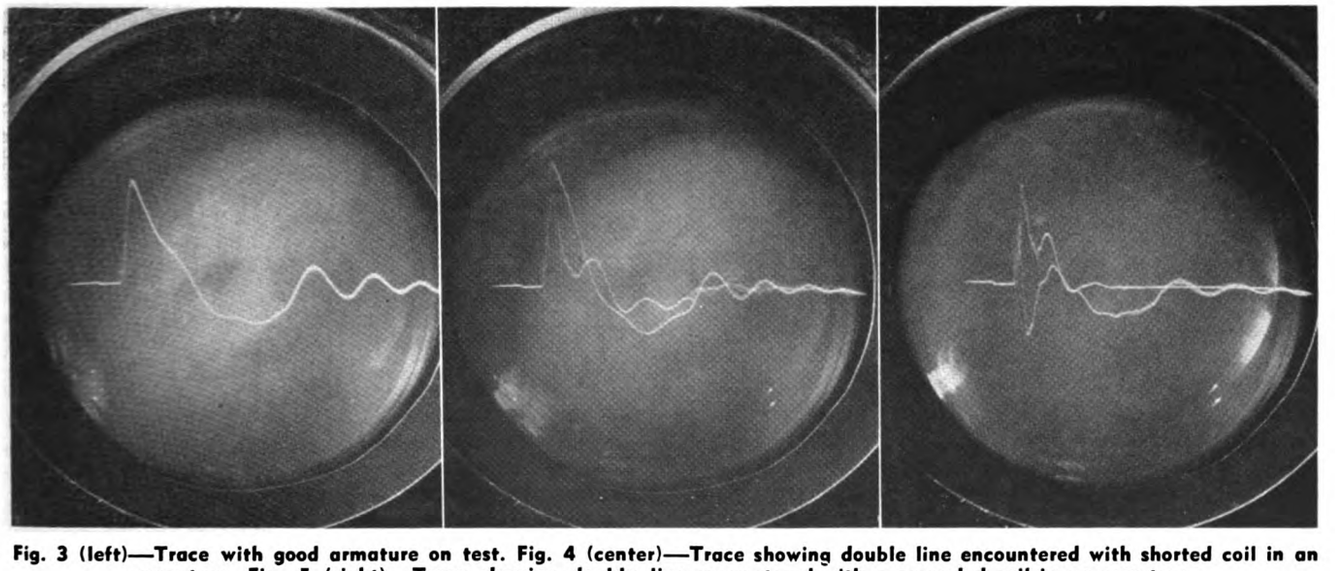


Fig. 3 (left)—Trace with good armature on test. Fig. 4 (center)—Trace showing double line encountered with shorted coil in an armature. Fig. 5 (right)—Trace showing double line encountered with a grounded coil in an armature

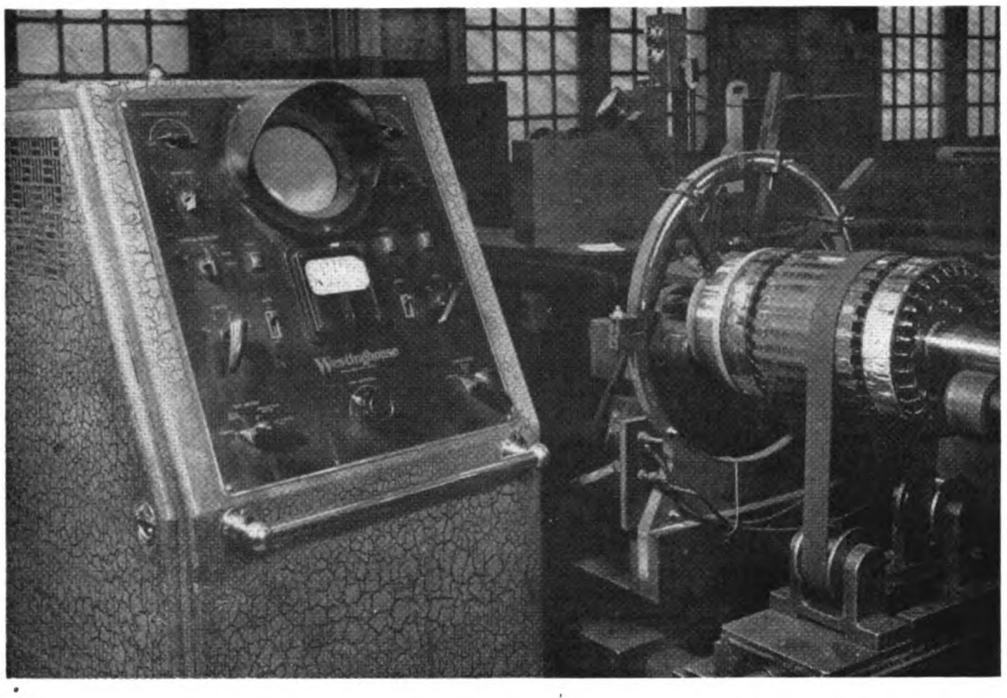


Fig. 6—A sample test arrangement showing brush rigging and belt for rotating armature

shown simultaneously on an oscilloscope. As different windings are checked, any faulted winding shows a markedly different wave shape and amplitude from the second trace on the screen, locating the trouble.

In the Westinghouse surge comparison tester, voltage is obtained by discharging a capacitor through the test winding. This produces a damped voltage surge with a steep front quite similar in shape to a lightning wave. As shown in Fig. 1, transformer T_1 charges capacitor C_1 through rectifier tube V_1 to some predetermined voltage. The cathode-ray control unit then pulses the grid of the thyraton tube V_2, allowing current to pass through protective resistor R_1, reversing switch S_1 and the test piece. The same pulse that fires the thyraton V_2 initiates a sweep trace on the cathode-ray tube. This trace is timed correctly to allow the operator to view the voltage wave impressed on the test piece.



Fig. 7—Portable surge comparison tester

The d.c. traction motor armature is placed between lathe centers, or in a suitable jig, when it is to be tested. A fixture with adjustable brushes is mounted over the commutator to accommodate the leads from the tester. The armature can be rotated by hand during test, but for large, heavy armatures it is easier to drive them by a belt, connected to a motor and suitable gear reduction box.

After the armature is in the fixture, leads "one" and "three" are connected to the commutator, one normal brush span apart. Lead number "two" is connected midway between "one" and "three." The winding switch should be set on "3-1." The lead marked "*G*" should make a good connection to the shaft and core. Brush and lead arrangement are shown in Fig 2. When all necessary arrangements have been made and voltage is applied to a good armature, a trace will appear on the screen similar to that shown in Fig. 3.

If there is a bar-to-bar short at any point in the armature, a trace similar to Fig. 4 will appear on the screen. The double trace will merge at different points as the armature is rotated. This will depend on the number of circuits in the armature. For a two-circuit armature, the traces will merge eight times as the armature is rotated once. A bar-to-bar short can be located by using an insulated test prod and successively shorting adjacent bars around the armature and observing the traces on the screen. If two adjacent bars are shorted and the traces move to new positions; this indicates that these two bars are not shorted within the armature. When there is no movement of the traces, it indicates the two bars under the probe are in the circuit containing the short. By observing the different points around the armature that are

in the shorted circuit, it is usually possible to pick out the one point closest to the fault.

When an armature under test contains a coil that is grounded to the core, a trace will appear on the screen similar to Fig. 5. In locating the grounded coil, it is necessary to rotate the armature and observe the traces on the oscilloscope screen. When a bar in the grounded circuit comes under the brush connected to lead "two," the traces will fall to zero and become a straight line. To locate the bar closest to the fault, it is necessary to determine which location gives the smallest voltage indication on the screen. On a two-circuit armature, there are only two bars which give nearly zero indication and usually one is less than the other.

When an armature contains two or more faults or a combination of grounds and shorts, detection of these faults is easy, but location of the faulty point becomes more difficult. The ability to locate a fault quickly depends upon the operator's experience with the tester. As the number of parallel paths in any armature increase, the difficulty of locating a fault in that armature also increases. The use of auxiliary equipment such as pick-up coils, isolation transformers, and special test circuits aid the operator in locating faults in multi-circuit armatures.

An overall test set up with a typical railway armature under test is shown in Fig. 6. One point to keep in mind while using the tester is that it should be grounded at all times and the core of the armature should be connected to the terminal marked "G" at the plug containing the test leads.

A portable model of the surge comparison tester is shown in Fig. 7. This tester is the same electrically as the one pictured in Fig. 6, except that the input power for the mobile tester is 1,840 watts, while that for the portable tester is 800 watts. The portable tester is 16½ in. wide, 26 in. high and 27 in. deep, and weighs approximately 180 lb. without cables, and 200 lb. with cables. The mobile tester is 29½ in. wide, 62 in. high, and 41 in. deep, and weighs 1,200 lb. approximately. Either model will perform the same test equally well, the only difference will be in the power input requirement and physical size.

D. W. COLLINS

Westinghouse Electric Corporation

Car Electrical Equipment

Questions and Answers

Q.—In a motor alternator, the a.c. terminals of a rectifier are connected across the secondary of a current transformer. What effect does disconnecting the d.c. terminal from the load have on the transformer and rectifier?

A.—The load should never be disconnected from the rectifier d.c. terminals unless these are short-circuited because the no load open circuit voltage across the secondary of the transformer is usually much higher than the normal voltage at rated load. The rectifier is subjected to this voltage, which, in some instances, may be more than double its allowable maximum voltage, causing it to break down electrically.

On the other hand, short circuiting the d.c. terminals cannot damage either the rectifier or the transformer because the transformer secondary current depends upon the ratio of secondary to primary turns and is, for all practical purposes, in inverse proportion to this ratio. If, for example, the primary has 10 turns and carries 10 amp., and the secondary has 100 turns, then it will carry 1 amp. When tht rectifier terminals are short circuited, this current is shunted away from the load but will remain 1 amp. and the d.c. voltage across the rectifier, which is equal to the resistance of the load, multiplied by the current, is reduced to zero.

L. B. HADDAD

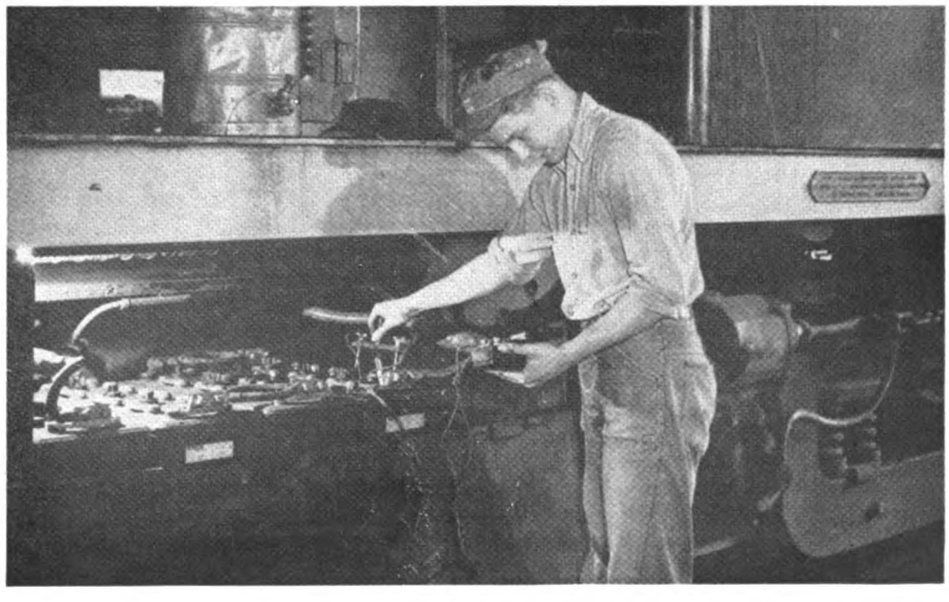
Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—What are the duties and functions of a diesel battery?

A.—Starting, lighting and control circuits.

Q.—What care should be exercised when working on a battery?



Using a voltmeter to locate a bad cell on a Diesel-electric locomotive battery

A.—(a) First open main battery switch; (b) Keep all flames away from battery; (c) Do not lay any tools on top of battery; (d) Provide full ventilation of battery compartment; and (e) Do not allow oil to drip or accumulate on top of the battery.

Q.—Why is it important to give attention to batteries and maintain them properly?

A.—The battery is the center of the entire electrical system of a diesel locomotive. Without the battery it is impossible to start a diesel unless an outside source of current is available. Battery maintenance is simple, but obviously, of crucial importance. Also, service life is increased.

Q.—What can you tell from open circuit readings?

A.—Open circuit voltage readings are of very little or no use in determining the true condition of a storage battery. A conventional volt meter, as used for reading diesel batteries, does not have a large enough scale to indicate the condition of a battery. Open circuit voltage readings can be used in laboratory analysis of storage batteries, but they have little or no use to the average battery maintenance man. Temperature, age and the state of charge of a battery, at the time voltage readings are taken, have a definite bearing on the readings.

Q.—Why are voltage readings higher when the temperature is low?

A.—Because of a change in the internal resistance of the cell.

Q.—What relation does temperature have on gravity readings?

A.—Correction of temperature must be made on the basis of plus or minus three points of gravity for each 10 deg. F. (acid temperature). Using 77 deg. F. as a base, add three points of gravity for each 10 deg. F. above base, and subtract three points for each 10 deg. F. below.

This correction must be considered a part of normal specific gravity readings because as the temperature of the acid rises, the acid expands and is, therefore, not as dense. The float then rides low, giving readings lower than normal. Conversely, when the acid is cold, the float rides high and the reading is higher than normal. Examples are shown in the following table:

Hydrometer Reading	Thermometer Reading	Correction	True Specific Gravity
1.250	87 deg. F.	plus 3	1.253
1.210	80 deg. F.	plus 1	1.211
1.180	64 deg. F.	minus 4	1.176

K. A. VAUGHAN

Gould Storage Battery Corporation

A.C. Air Conditioning For Railroad Cars

An experimental alternating-current drive for railroad car air conditioning, built by the Westinghouse Electric Corporation, has been undergoing trials in regular car service on the Chicago, Rock Island & Pacific. It consists of four units:

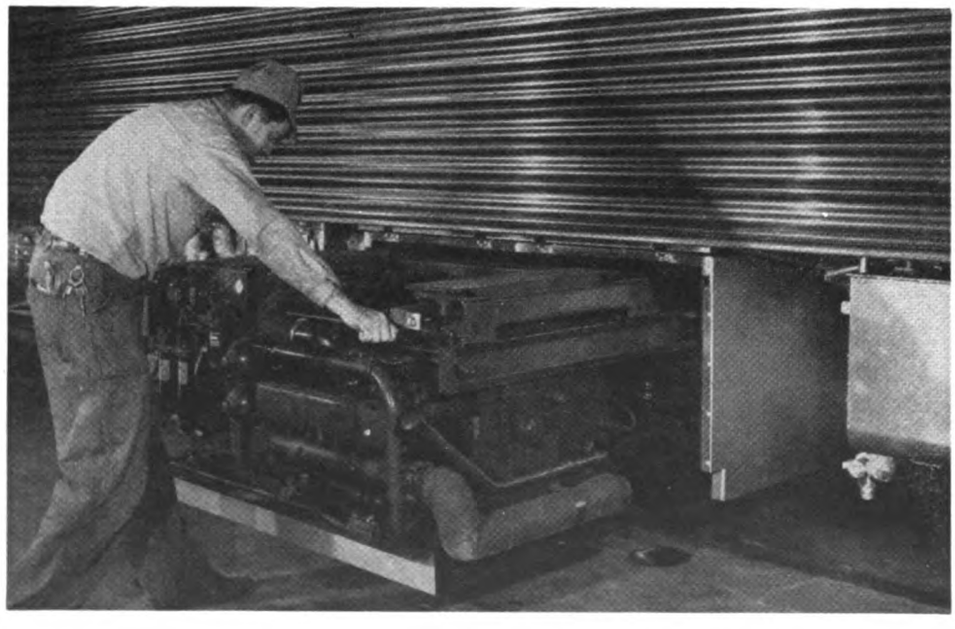
(a) The power plant is a Hercules engine, direct coupled to a 30-kva. alternator mounted as a package under the car. It can be withdrawn on rails as shown for servicing or replacement. A complete power-plant change can be made in a few minutes.

(b) The compressor unit is made up of two standard 5-hp. hermetically-sealed, motor-driven compressors, operating in separate refrigerant circuits, also built as a single, under-car package.

(c) A condenser, to remove the heat of compression combined with the engine radiator is mounted under the car as a package.

(d) Evaporators and heating coil of essentially standard design, but specially shaped, are mounted within the coach.

In cold weather the output of the a.c. generator is used to warm the car. Arrangements could be made to utilize the exhaust heat of the engine requiring no train line steam heat except for extremely low outside temperatures. The a.c. generator supplies power for all lighting, water cooler, and other electric devices.



The power plant rolled out for servicing

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

AIR BRAKE EQUIPMENT (*continued*)

114-Q.—What is the purpose of the dynamic brake interlock? A.—The dynamic brake interlock is furnished with dynamic brake equipment and is used to release or prevent an automatic brake application on the locomotive if the dynamic brake is on.

115-Q.—How is the independent application and release effected? A.—Independent application and release of the locomotive brake is available at all times irrespective of dynamic brake operation.

116-Q.—When is the dynamic brake nullified? A.—The dynamic brake is nullified in emergency or any penalty application, allowing the automatic brake to operate.

117-Q.—What air brake equipment is used on road switchers? A.—The 6-SL equipment. Older models had the 6-DS equipment.

118-Q.—Primarily, what does this equipment consist of? A.—The automatic brake valve, independent brake valve, bell ringer valve, brake-pipe cut-out cock, feed valve and distributing valve.

MISCELLANEOUS EQUIPMENT

119-Q.—Describe the location and operation of the locomotive bell valve. A.—The locomotive signal bell is located under the chassis behind the pilot on road locomotives and behind the right front corner steps on road switchers. It is operated from main reservoir air through the lower control valve on the right side of the brake valve pedestal.

120-Q.—Where is the shut-off valve? A.—It is built in the needle valve adjustment at the bell.

121-Q.—How is the locomotive horn operated? A.—From main reservoir air through the control valve located at the engineer's position.

122-Q.—Where is the horn shut-off valve located? A.—On road locomotives, it is located in the nose to the rihgt of the door, while on road switchers the cut-out cock is located under the cab at the front right side and is reached by opening the side door.

123-Q.—Where is the sander valve located on the road switchers and how many positions does it have? A.—It is the upper control valve on the right side of the brake valve pedestal and has three positions, reverse, neutral and forward.

124-Q.—Explain these positions. A.—The extreme left position gives reverse sanding. The extreme right position admits main reservoir air to the sander automatic valve giving forward sanding. In neutral position the exhaust warning port is closed and no sand flows.

125-Q.—Are shut-off cocks provided? A.—Yes. One for each truck, located on the right side under the chassis near the sander automatic valve.

126-Q.—Describe the sanding valve on road locomotives. A.—A single acting independent sanding valve is employed, which is operated by pulling the lever all the way back, admitting main reservoir air to the sander automatic valves.

127-Q.—Are shut-off cocks provided for road locomotives? A.—Yes, one for each truck, located under the chassis on the right side near the sander automatic valve.

128-Q.—Describe the windshield wipers on road locomotives. A.—Two wipers, operated from main reservoir, are provided, the speed of each being controlled independently by regulating valve which also turns the wiper on or off.

129-Q.—Where are they located and where is the shut-off cock? A.—One is located on the engineer's control stand, and one is on the panel at the fireman's position. The shut-off cock is located in the nose to the right of and near the door.

130-Q.—How about the windshield wipers on the road switchers? A.—Four are provided on road switchers. They are operated from main reservoir pressure, the speed of each being controlled independently by a needle valve which also turns the wiper on or off.

131-Q.—Where are the operating and shut-off valves located? A.—The operating valves are located at each wiper at front and back windows on the right and left sides of the cab. The shut-off valve is located in the bottom of the control stand and reached by removing the lower cover plate under the brake valve.

132-Q.—Where are the cab heaters located? A.—On road locomotives a heater is located on each side of the cab in front of the seats while on road switchers one is provided and it is located on the right side in front of the operator's position.

133-Q.—How do the cab heaters function and how is their output controlled? A.—Hot water from the engine cooling system passes through the heaters, and motor driven fans provide air circulation. Rheostat switch in easy reach of the operator are used to vary the output. Water inlet and outlet valves are provided for each heater.

134-Q.—Where are the inlet and outlet valves located? A.—On road locomotives they are located near the heater in the nose adjacent to the contactor compartment. On road switchers they are on the right and left sides, respectively.

135-Q.—How are air pockets eliminated? A.—A manual vent valve located on the top of each heater, is provided for this purpose. This valve should always be opened when draining water from the engine.

136-Q.—Are these locomotives equipped with defrosters? A.—Road locomotives only are equipped with two motor driven defroster fans, which blow cab heater air on the insides of both windshields. Each motor is operated individually by a rheostat switch which will vary the output of the defroster as well as turn it on or off.

137-Q.—Where are the switches located? A.—One on the operator's control stand and one on the fireman's panel.

138-Q.—Are classification lights provided? A.—Yes. On original model road locomotives on each side of the nose having bulls-eye lenses, one facing forward and one to each side. On new design locomotives one lens is provided on each side which reflects light forward and to the side.

139-Q.—Describe the lights further. A.—Accessible from the nose is a classification light lamp on original model locomotives cage containing three colored lenses; red, green and yellow. On new locomotives colored lenses are mounted in a pivot-type frame and dropped into position.

140-Q.—How is the desired color obtained? A.—The cage is equipped with a locking pin which when pulled out disengages the locking device so that the cage or pivoted lens may be positioned to obtain the desired colors. When the colored lenses are out of position, the white light will show, thus making several combinations available.

Schedule 24-RL Air Brakes

Safety Control Feature (*continued*)

1031-Q.—What must be done to move piston 161 to release position? A.—Pressure must be equalized on both sides of the piston.

1032-Q.—How is this accomplished? A.—It is necessary to move the brake valve handle to lap position, cut off supply to brake pipe port *2b* and depress either the brake valve handle or the foot valve, or make an independent application with about 30 lb. in control pipe *16*.

Over Speed Protection Feature—H-24-D-Relayair Unit

1033-Q.—When does the Overspeed Protection Feature function? A.—When the engineman fails to keep the train below a predetermined speed.

1034-Q.—What happens if the speed is not thus held reduced? A.—An application of the brakes will occur.

1035-Q.—What does the overspeed feature as installed with this brake equipment consist of? A.—(1) FA-4 magnet valve. (2) Overspeed whistle. (3) Volume reservoir and check valve with choke. (4) Service application brake valve overspeed control details, or Emergency application valve overspeed control details.

1036-Q.—How does the FA-4 Magnet Valve function? A.—Operates the service or emergency application piston of the brake valve to cause a brake application when overspeed prevails.

1037-Q.—What is the purpose of the overspeed whistle? A.—The overspeed whistle blows to indicate that an overspeed brake application is initiated.

1038-Q.—What is the purpose of the volume reservoir and check valve with choke? A.—To stabilize the operation of the brake service application piston *112*.

1039-Q.—What does the service application brake valve overspeed control details consist of? A.—Cut-out cock *134*, service application piston *112*, and slide valve *114*.

1040-Q.—What does the emergency brake application valve overspeed control details consist of? A.—A cut-out cock in pipe *10* and an emergency application piston *161*.

1041-Q.—When equipped with the service application portion and with the train operating at normal speed, how is the overspeed control system charged? A.—By main reservoir air from chamber *A* located below service application piston *112*, of the brake valve.

1042-Q.—How does the air flow through the brake valve? A.—Through choke *K* in piston *112* to chamber *B* and passage *10* to pipe *10*.

1043-Q.—From pipe 10 where does the air flow when charging? A.—To the volume reservoir with check valve and choke, the H-24-D Relayair valve unit and the FA-4 magnet valve.

1044-Q.—How are the volume reservoir and H-24-D Relayair valve unit charged? A.—The volume reservoir is charged through the check valve and choke and the relayair valve unit is charged as previously described under safety control.

1045-Q.—What is the first movement as overspeed occurs? A.—The *FA-4* magnet valve is de-energized.

1046-Q.—With the magnet valve de-energized, what then is the result? A.—Spring *4* moves lower valve *3* off its seat and seats upper exhaust valve *3a*.

1047-Q.—What flow of air is the result of this movement? A.—Air from chamber *A* flows to chamber *B* and the overspeed whistle, which blows, indicating that an overspeed application is initiated.

1048-Q.—How then, is an application of the brakes brought about? A.—Air from the volume reservoir and from chamber *B* on top of the brake valve application piston *112* is quickly vented through the FA-4 magnet valve, overspeed whistle pipe and the overspeed whistle. Thus piston *112* is moved up to "Application Position."

1049-Q.—How does the Emergency Application Portion function? A.—As explained under Safety Control when the No. *10* pipe is vented through the FA-4 magnet valve.

1050-Q.—How many relayair valve units are used with the H-24-D unit? A.—One. The Cut-off relayair valve unit.

1051-Q.—How does the Cut-off relayair valve function? A.—To suppress a safety control application when the brake is applied with about 30 pounds pressure in the relay valve control pipe *16*.

1052-Q.—What also does this valve provide? A.—Permanent suppression when used with the overspeed suppression relayair valve.

Overspeed Protection Feature with H-24-E Relayair Valve Unit

1053-Q.—How does the overspeed protection feature as incorporated with this equipment, function? A.—When the engineman fails to keep the train below a predetermined speed.

1054-Q.—Do the brakes apply immediately? A.—No. However, if the speed is not reduced manually or the brake is applied which will bring the train speed below the overspeed setting within 6 seconds after the overspeed whistle sounds, a brake application will occur.

1055-Q.—What does the overspeed protection feature with this equipment consist of? A.—Similar to that of the H-24-D-Relayair Valve Unit with the addition of an overspeed application valve.

1056-Q.—How does the overspeed application valve function? A.—To initiate a brake application when overspeed occurs, as controlled by the FA-4 magnet valve.

1057-Q.—How is the overspeed control system charged? A.—By main reservoir air from chamber *A* below service application piston *112* to chamber *B*, passage *10* to pipe *10*.

1058-Q.—Describe the flow from pipe 10? A.—From pipe *10* to cononnection *17* of the *H-24-E*-Relayair Valve where it connects with passage *7* and flows to the overspeed application valve.

1059-Q.—What is the position of the overspeed application valve with train operating at normal speed? A.—With train operating at normal speed and no air pressure in chamber *E*, diaphragm *10* is held in its upward position by spring *6*. This unseats upper valve *17* and permits spring *19* to move lower valve *15* to its upper seated position.

1060-Q.—How does this set up affect the overspeed control system? A.—Main reservoir air from passage *7* and pipes *17* and *10* and the brake valve service application piston chamber *B* is cut off from the atmosphere.

1061-Q.—What takes place when overspeed occurs? A.—The FA-4 magnet valve is de-energized.

1062-Q.—What results from de-energization of the magnet valve? A.—Spring *4* moves supply valve *3* off its seat and seats exhaust valve *3a*.

1063-Q.—What flow of air is then permitted? A.—Main reservoir air from pipe *2* and chamber *A* then flows past unseated valve *3* to chamber *B* and into the overspeed actuating pipe *1*.

Steam Locomotive Boilers

By George M. Davies

Oil Versus Coal

Q.—Some consideration has been recently given on our road to converting several of our steam locomotives from coal to oil burning. Is there any available data on the consumption of oil versus coal for a steam locomotive?—S. T.

A.—The Bureau of Railway Economics published, in 1942, a statement showing the unit performance with each of the several kinds of fuel used in road freight service, road passenger service and yard switching service for individual Class 1 railroads of the United States. The comparison of oil and coal consumption given is summarized as follows—

Switching Service—per Locomotive Hour
Pounds of coal—steam locomotives 766
Gallons of fuel oil—steam locomotives 58.28
Freight Service—per 1000 gross ton-miles (including locomotive and tender)
Pounds of coal—steam locomotives 113
Gallons of fuel oil—steam locomotives 8.10
Passenger Service—Per car-mile
Pounds of coal—steam locomotive 16.8
Gallons of fuel oil—steam locomotives 1.06

Factor of Safety

Q.—How is the factor of safety arrived at? For locomotive boilers it is 4. What I want to know is how to arrive at that 4.—E.F.K.

A.—The term "factor of safety" is defined as the ratio of the ultimate strength of material or structure to the allowable stress.

In boiler work the term factor of safety can be taken as the ratio of the bursting pressure to the working pressure, thus:

$$\text{Factor of safety} = \frac{\text{Bursting pressure}}{\text{Working pressure}}$$

All locomotive boilers operating in the United States must have a factor of safety of 4 to comply with the locomotive inspection law.

This law requires:

Rule 2—The lowest factor of safety for locomotive boilers, which were in service or under construction prior to January 1, 1912, shall be 3.25.

Effective October 1, 1919, the lowest factor shall be 3.5.

Effective January 1, 1921, the lowest factor shall be 3.75.

Effective January 1, 1923, the lowest factor shall be 4.

The factor of safety of 4 is an arbitrary margin of safety set by law to protect against:

1. Deterioration due to corrosion.
2. Errors in workmanship.
3. The interdependence of parts.
4. The probability of overload.
5. Stresses due to method of suspension.
6. Lack of homogeneity in the material.

The factor of safety computed by the following formula must not be less than 4 in order to comply with the locomotive inspection law:

$$FS = \frac{TS \times t \times E}{R \times W \times P}$$

where

T=ultimate tensile strength stamp on shell plates, lb. per sq. in.
t=minimum thickness of shell plates in weakest course, in.
E=efficiency of longitudinal joint or ligaments between tube holes (whichever is the least).
R=inside radus of the weakest course of the shell, in.
WP=allowable working pressure, lb. per sq. in.
FS=factor of safety.

EDITORIALS

Air-Conditioning Still Presents Problems

In a discussion of air-conditioning equipment design and maintenance at a recent meeting of the Car Foremen's Association of Chicago, numerous problems or difficulties in operation were cited and suggestions advanced for effecting improvement.

For example, it was explained that water-cooled condensers in early designs tended to collect road dust and cinders, particularly in the West, to such an extent that condenser sumps had to be cleaned after each trip. Clogged sprays, burned-out pump motors and defective controls soon proved the impracticability of this type of condenser. With the introduction of Freon, air-cooled condensers became feasible and the first of these were well built, electrically driven and generally separated from the compressor location to minimize vibration. Low maintenance and practically leak-proof trouble-free operation were additional advantages.

When high-production methods and possibly other reasons led to combining the compressor box, condensers and condenser fans in a single unit, however, practical car men found that not only was the compressor unit difficult to service but it proved a continual source of Freon leaks, broken piping and inefficient air supply to the condensers. Many postwar installations have accordingly returned to the use of water-cooled condenser units which completes the cycle and almost seems like looking for trouble. In defense of the water-cooled condenser, it may be said that post-war types have been greatly improved and designed to overcome most of the difficulties experienced with earlier designs.

Similarly, air distribution, particularly in sleeping cars, confronts designers with problems not yet entirely solved. In first attempts to air condition these cars, cooling coils were located in individual rooms or compartments, each with its own air filter and fan and designed to circulate air in a limited area quietly, quickly and evenly with individual control. To reduce costs, all of this equipment was eventually consolidated in a single over-head air-cooling unit which must force air from one end of the car to the other through limited duct areas with proportionately high pressures and velocities, drafts and wind noises.

It was pointed out at the meeting referred to that the human element enters at this point and often results in one passenger after another shutting off his individual air damper, thus causing a progressive increase of air delivery to remaining accommodations. By that time the noise from air outlets may become highly objectionable and possibly cause all of them to be closed with attendant serviceing of the cooling evaporator. Both railway engineers and manufacturers' experts are concentrating on this one.

Core Loss and Hot Spots

Reduction of traction-motor capacity, due to increased core loss, has been discussed previously in these columns, but up to the present time there appears to be little information available on the subject. It has been suggested that some of the methods used to clean armature cores for rewinding may burr over the edges and thereby short-circuit the laminations sufficiently to cause an objectionable increase of core loss. This, in turn, might cause sufficient heating to reduce appreciably the motor's thermal capacity.

In discussing the question, one of our British contemporaries, W. S. Graff-Baker, chief mechanical engineer, London Transport Executive, Acton Works, London, tells of an early experience. He relates that when he came out of college, he was somewhat shocked to find cores being filed. To evaluate the question, he had four blocks made of armature stampings of similar size and shape. One block was left untouched, one was filed, one drifted and one milled, respectively. The four blocks were provided with like coils on a like number of teeth. For purpose of test, the coils were connected in series and an alternating current passed through the coils. It was found that the temperatures of the blocks were not affected by the method of dealing with the slots; all blocks came up to the same temperature. In looking back on this experiment, Mr. Graff-Baker thinks he may have overlooked the fact that the frequency of the alternating current flux in the teeth of an armature in regular service is considerably higher than the frequency of the current used in the test.

In other words, the result of such tests leaves the question of traction motors still in doubt, and in an attempt to shed light on the subject, a question is published in the Consulting Department of this issue which reads as follows: "What is the best method to use for cleaning up slots in armature iron prior to winding or rewinding? Have you any evidence or information to indicate that improper cleaning may cause excessive core loss or hot spots?"

Tests have been made on the stators, (armatures) of a.c. machines, in which test windings were applied and the cores painted with paraffin. Current values were increased until the paraffin was melted. In some cases, the paraffin melted first in small localized areas or hot spots.

It seems quite possible that in the case of traction motors, the faults might be confined to spots, a circumstance which could be more harmful than a slight increase in temperature over the entire armature.

At least, the question still remains. Perhaps someone has made tests which show conclusive answers. If not, descriptions of the practices used in manufacturers' or railroads' shops may shed light on the subject, since they are based on experience. Readers are invited to discuss the subject.

Logical Extension Of the Assembly Line

One of the important factors in the ascendency of the diesel locomotive over the steam has been the continuing reduction in the price differential between the two forms of motive power. The principal reason that the diesel manufacturers have succeeded in narrowing the gap has been that their product has been standardized to a vastly greater extent than steam locomotives, and the standardization has permitted the economic adoption of the assembly-line or production-line technique.

The same technique can be and has been applied to maintenance work, although to a lesser extent for the simple reason that repair work in general does not by its nature lend itself to production methods as well as manufacturing. There are, nonetheless, numerous operations to which the production line theory has been applied successfully. Assembly lines have been set up on different roads for such things as overhauling complete diesel engines at eight or ten stations to comparatively small items such as cylinder heads and injectors at about half that many stations.

Few if any people doubt the advisability of setting up production lines where the volume of work is sufficient to justify the cost of the setup. The big division of opinion arises over the number of any given part that must be repaired during a period of time to make the cost of the added facilities worth while. One thing that can cause this number to vary between different shops is the facilities currently employed in the present repair setup. One shop may have facilities that can be converted to a production setup at far less cost than another shop, and this of course would justify the production or assembly-line arrangement for a smaller volume of work.

In general, however, the majority of shops should not find too much variation in the cost of putting repairs to any certain part on a production-line basis. There is probably cause to investigate when any but minor discrepancies exist between the volume that one shop considers sufficient to justify an assembly-line repair and the volume that a second shop feels is needed. The potential savings from selective assembly-line repairs are too great to risk their being overlooked, not only from the saving in cost of the particular repair, but as well from the increased quality that frequently results from having the same man perform the same operation every day.

NEW BOOKS

STRENGTH OF STAINLESS-STEEL STRUCTURAL MEMBERS AS FUNCTION OF DESIGN. *By Michael Watter, D.Eng., director of research, Budd Company, and Rush A. Lincoln, D.Sc., Allegheny Ludlum Steel Corporation. First edition. Published by the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. 154 pages, 8 in. by 10½ in.; cloth bound. Price, $5.*

This book discusses the basic properties of light-gauge stainless-steel strip of various tempers at room temperatures, and methods for calculating the allowable loads for structures made from it. Its contents are for the most part taken directly from unpublished reports D-1 and 110 by Dr. Michael and members of the research and development department of the Budd Company. These data were organized and supplemented by Dr. Lincoln. The first 84 pages, with the accompanying first 61 figures, represent a detailed description of the basic properties of stainless steel. On the next five pages these data are applied to the behavior of columns. A simplified procedure for calculating column failures that occur through buckling in compression without twisting is then described, followed by an explantion of the origin of the data used. Behavior in bending and shear is then discussed. In the last part of the book the data are adapted to the analysis of open-section columns in compression that fail by twisting.

MECHANICAL ENGINEERING LABORATORY. *By Charles W. Messersmith, professor of experimental mechanical engineering, and Cecil F. Warner, associate professor of mechanical engineering, Purdue University. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 160 pages, 8½ in. by 11 in.; paper covered; plastic binding. Price, $3.50.*

A set of notes prepared for students in mechanical engineering at Purdue University is the basis for this book. Chapter 1 sets forth the objectives of a laboratory course. The text material of succeeding chapters is arranged in a way to satisfy those objectives as far as possible. Material usually covered in thermodynamics and heat-power textbooks has been omitted where possible, and much has been done to reduce to a minimum the number of equations in which students can "plug in values and crank out answers." Test codes and procedures formulated by various engineering societies are frequently referred to in order to remind the student that such guides exist and should be consulted as well as various handbooks and other works of reference. Pointed out also is that one of the aims of any mechanical engineering laboratory course should be to improve the report-writing ability of the student. Pressure, temperature, power, and flow measurements are treated in separate chapters. The remaining chapters cover Heating Value of Fuels, Selected Physical Properties of Lubricants, Analysis of Flue Gas or Products of Combustion, Fluid Pumps, Stationary Steam-Generating Units; Steam-Driven Prime Movers, Heat Transfer, Internal Combustion Engines, and Vapor Compression Refrigeration Plant.

NEW DEVICES



Bicolored Fused Lenses

Illustrated here is a set of bicolored fused lenses, designed to protect the eyes of workers engaged in heat treating and furnace operations, scarfing and burning operations, open hearth and blast furnace operations, kiln processes and welding. They have been designed and are manufactured by the American Optical Company, Southbridge, Mass.

Because the lenses are fused into one piece, uniform thickness is assured, and they have no rough edges. The lenses are beveled to fit spectacle goggles or cup-type goggles and are made in regular and 6-curve, round and FV3 shapes.

In comparison with their older two-piece bicolored lenses, the new fused type can be replaced more easily and quickly in goggle frames. The fusing process at the same time, eliminates the possibility of light streaks being present.

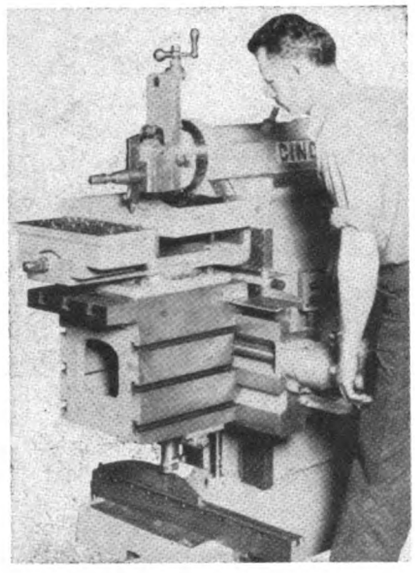
The following glass combinations are available: cobalt-clear; Noviweld-clear; calobar-clear; and Noviweld-Calobar in one-half and one-half combinations.

Nipple Chuck Threader

A nipple chuck for the threading of short nipples has been announced by the Ridge Tool Company, Elyria, Ohio. This Ridgid nipple chuck is of a design which fits any threading machine or vise without special tools, parts or adjustments, according to the manufacturer.

It requires no adjusting or changing of the stop plug which is an integral part of the device, and is said to be always automatically in position for use. Nipples to be threaded are screwed in by hand, and after threading, are released by a turn of the chuck, so they can be unscrewed by hand.

Pipe adaptors are made for ⅛, ¼, ⅜, ½, ¾, 1, 1¼ and 1½-in. pipe; the nipple chuck itself holds 2-in. pipe. A handy patented carrier is furnished with each complete set.



Follower Type Duplicating Shaper

The unit illustrated is used for automatically shaping contours on dies, clamps, cams and other parts without laying out the contour on the work and shaping to a line as is normally done when shaping parts. This device, a follower type shaper, has been brought out by The Cincinnati Shaper Company, Cincinnati, Ohio.

Follower equipment can be supplied on any stroke or size of Cincinnati Shaper. It can be used for regular shaper work as well as automatic duplicating. Change-over is simple and quick.

The rail elevating screw is disconnected and retracted when duplicating so the table and rail are free to move vertically. Rail and table are supported on the masterform by the steel support post equipped with a roller. The masterform to be duplicated is made of ½ in. steel and clamped in the holder that is secured to the pad on the base. The table progresses horizontally by automatic feed. Table, rail and work follow the vertical and horizontal movement of the roller as it travels over the masterform.

As shown, a die can be machined by feeding the tool down in consecutive cuts to rough out the die and with a final finish cut to complete the surface. The limiting angle of climb is approximately 20 deg.

Cincinnati Shapers may be equipped with other types of duplicating followers for more intricate contours or shapes.

Journal Box Plug Retainer

A journal box dust guard plug retainer that holds plugs in place in spite of vibration, car dumping, and other severe service conditions has been placed on the market by the Gustin Bacon Mfg. Company, Kansas City, Mo.

These retainers can be used with all types of wood dust guard plugs now in common usage. They can be applied without disassembly of the journal. No bending, locking or fitting is necessary—the retainer is slipped over the plug, and automatically locks as it is driven into place. It can be removed and used over and over again.

Manufactured of spring steel, it affords positive locking to both sides of the dust guard well.



Megger Ground Tester

An instrument for measuring resistance to earth of ground connections, called the CVM Megger Ground Tester, is now being marketed by the James G. Biddle Company, Philadelphia 7, Pa. It provides a dependable and easy method for ascertaining if the resistance to earth of man-made grounds is sufficiently low to insure their correct operation and to minimize dangers due to lightning.

The set has its own generator for supplying test current and is therefore always

ready for service without dependence on battery or other supply. Each instrument has two scales, permitting open well-proportioned markings. Two ranges are available, 0 to 40 and 0 to 200 ohms; 0 to 100 and 0 to 500 ohms.

Corrosion Resistant Aluminum Paint Base

A patented process is now being offered to others for the protection of aluminum. This Pylumin process, developed by the Pyrene Manufacturing Company, Newark 5, N. J., accomplishes two things. It gives an attractive coating definite corrosion-resistance value if no paint finish is applied. In addition, it protects the metal by providing an adhesive and efficient base for paint finishes.

The manufacturer claims that Pylumin is simple to operate since it is an immersion process and employs a single powder whose ingredients have been proportioned and pre-mixed. The solution is easily maintained by a simple test kit and, when necessary, by the addition of the single powder. The costs of installation and operation are also low. Ordinary heated steel tanks are all that is required. Unless there is an exceptional amount of grease and dirt on the parts to be processed, no special cleansing is required.

This process is adaptable to either large or small scale production and it can be used widely on varying products made of aluminum and aluminum alloy. There being no dimensional changes, it is not necessary to make allowances for close tolerances.

Car Wheel Mounting Press

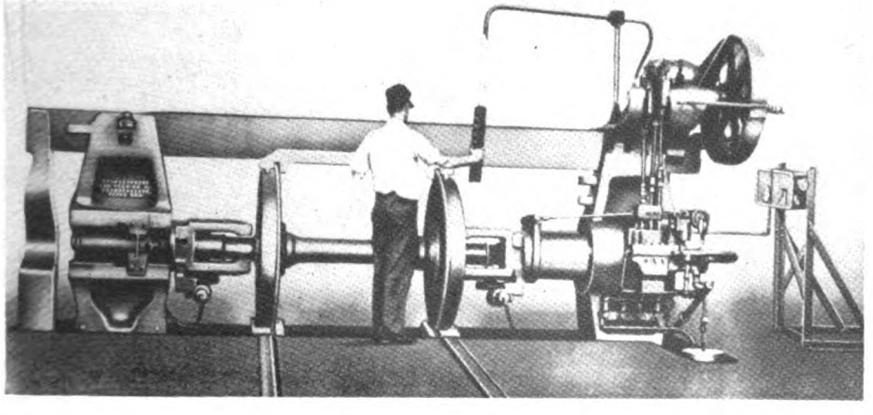
The illustrated unit features centralized electrical push button controls, by means of which all the operations necessary to press MCB standard car wheels on their axles can be handled by a single operator. These push buttons are mounted on a pendant suspended from an adjustable swing arm, permitting wide latitude in the operator's movements.

With this press, available from the Chambersburg Engineering Company, Chambersburg, Pa., one man can mount and gauge the wheels from the same station. This effects a saving in labor over the conventional mounting press, where one man gauges while another operates the press by individual manual controls.

Electrical controls on the Production Mounter provide for operation of the press ram, control positioning of the stops in the yokes and operate the pneumatic "kick-out" cylinder in the resistance beam to push the completed assembly free of the yoke for rapid removal from the press.

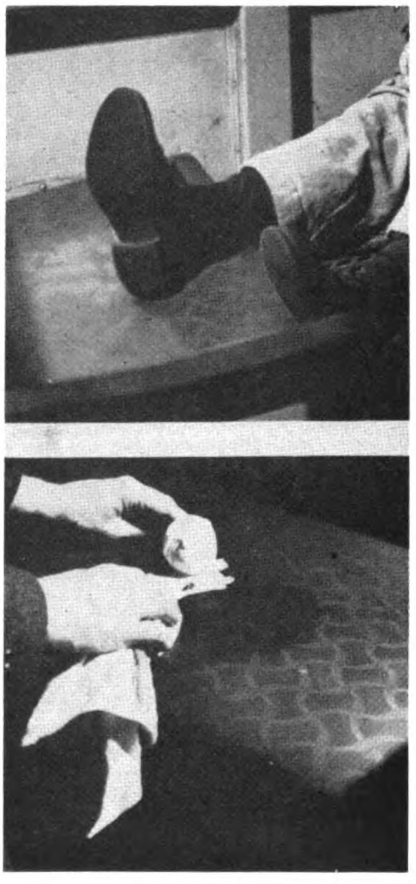
Mounted one above the other on the pendant, the push buttons are provided to: Advance the ram quickly under air pressure; apply hydraulic pressure rapidly, moderately, or inch; hold pressure at any desired tonnage; instantaneously release all pressure; position right-hand or left-hand stop within the mounting yokes; and operate the "kick-out" plunger.





Electric Hand Tachometer

A hand tachometer, Type 25D, with speed measuring ranges of 100 to 1,000, 200 to 2,000 and 500 to 5,000 r.p.m. and 10 to 100, 20 to 200, and 50 to 500 r.p.m., has been made available by the Metron Instrument Company, Denver 9, Colo. These are new ranges, and suited for speeds encountered in motor and generator testing, process control, and maintenance work. Range extending adapters are available to measure speeds as low as 20 r.p.m. and as high as 50,000 r.p.m. for special applications. The meters have quick response and can be used for acceleration tests. They have a self-calibrating check circuit and are undamaged by overspeeding or selection of wrong range. They have low operating torque, and the maker assures sustained high accuracy with long life.



Glass Fiber Coach Seats

Carelessness of commuters has little effect on railroad coach seats covered with fabric made of woven glass fiber coated with Vinylite resins. Coated with these resins, the illustrated glass fiber upholstery and window shade fabric is manufactured by Cordo Chemical Corporation, Norwalk, Conn.

This coating provides resistance to wearing stress that enables the material to survive flexing, and such pressures as a woman's high heel on the seat, as well as abrasion of foot-resting shoes (top). Dirt and soot, oil and grease, mildew and food stains (bottom) are easily removed with soap and a damp cloth. The fabric's resistance to fading, tearing and stretching are said to combine to make it ideal for rail coach window shades.

Vinylite resins in the material protect it from the sulfuric acid fumes in soft

coal smoke. If discolored by a cigarette, the fabric can be retouched with Vinylite resin solution in a matching color.

The material is available in a variety of colors and patterns, and is priced in the range of medium grade upholstery fabrics.

Traveling Table Grinders

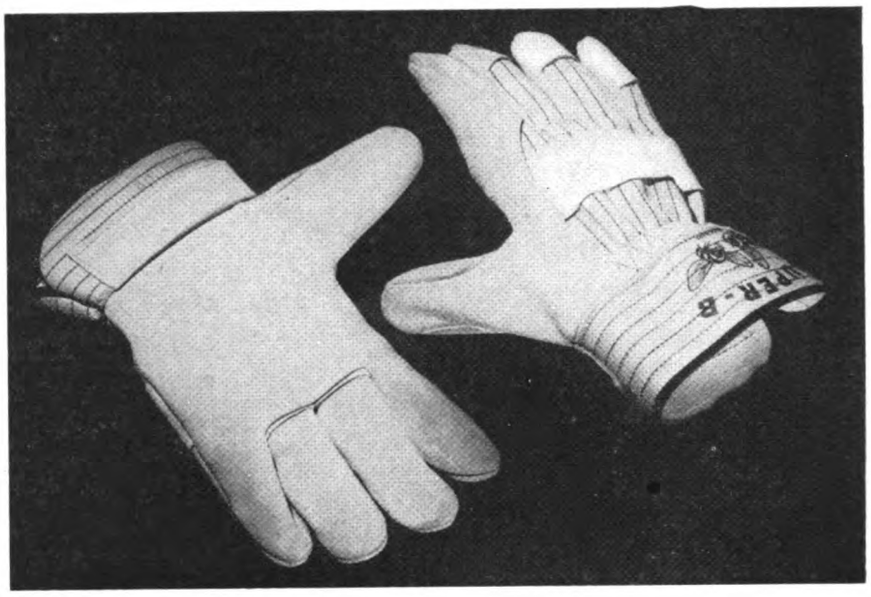
Three additional sizes have been added to a line of plain grinding machines and traveling table roll grinding machines. The new sizes are 16 in. heavy duty and 20 and 24 in. plain grinders; and 16, 20 and 24 in. roll grinders. They are manufactured by the Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

The grinding wheel spindle bearings are the Filmatic type. This construction consists of segments which are free to rock slightly in the housing bore, thereby admitting wedge shaped oil films between them and the single journal diameter as rotation occurs.

A d.c. motor, controlled electronically from an alternating current source, drives the table through a rack and pinion. This type of drive provides dial selection of an infinite number of traverse rates from 3 to 120 in. per min. To eliminate shock, the table automatically accelerates and decelerates at table reversal. Table tarry may be adjusted independently at each end of the stroke. Coolant flow and headstock spindle rotation automatically start and stop with the table traverse, or independently, as desired. An individual circulating system supplies filtered oil to the grinding wheel spindle bearings. A second circulating system automatically lubricates the table and cross ways.

The headstock is a dead spindle, d.c. motor driven unit, having a speed range of 20 to 72 r.p.m. for the 16 in. size, and 15 to 54 r.p.m. for the 20 and 24 in. sizes. The taper hole in both headstock and footstock spindles is No. 15 Brown & Sharpe.

Plain machines are built in seven lengths at two foot intervals, from 48 to 192 in., while the roll grinder style is built in the same lengths up to 168 in. Principal power requirements are 20 hp. for wheelhead motor; 2 or 3 hp. for headstock motor; 1½ hp. for table drive motor.



Wing Type Work Glove

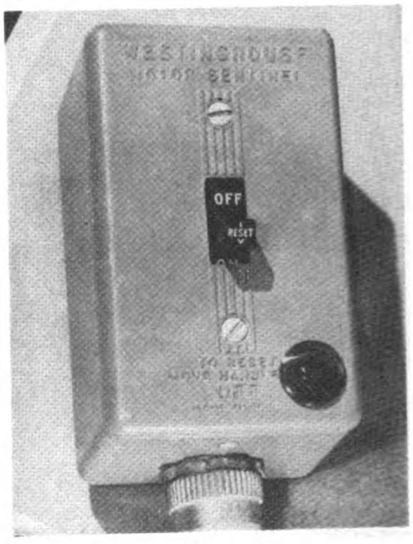
An all purpose work glove with a wing-type thumb has been announced by the Richmond Glove Corporation, Richmond, Ind. It is designed for heavy materials handling wherever protection is required.

An outstanding feature of the glove is the all-leather "Dura-Thumb". One continuous seam on the back of the glove's thumb assures long life. It eliminates seams on the front and thus insures more usability where thumb meets the palm.

Made of chrome-tanned, side split, pearl-grey cowhide with striped herringbone flannel back, the glove has a water-resistant cuff which may be dry cleaned. It has a seamless first finger and reinforced welting around the second and third fingers. A double stitch is used along the back cuff to the first finger for greater strength. A heavy elastic band is used for form fitting around the wrist.

A separate "pull" blends neatly into the matching cuff. It has a flannel lining which is provided for finger and palm comfort while leather knuckle straps and tips also offer additional hand insurance.

Gloves are available in two types, the Wing King with a 4½ in. gauntlet or the Super B with a 2½ in. safety cuff.



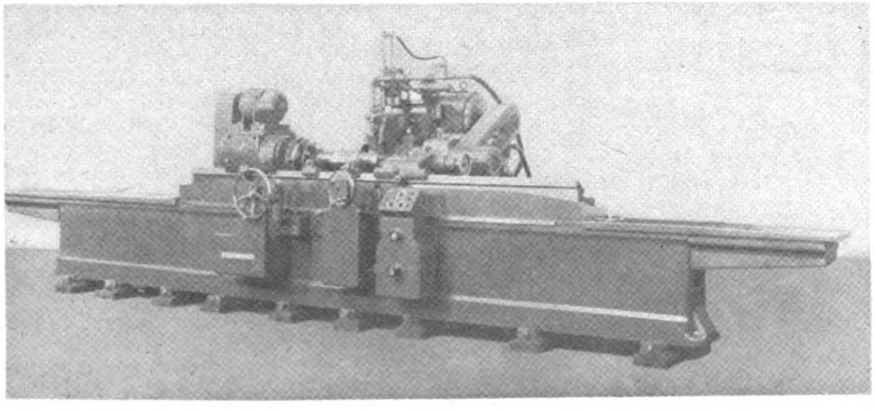
Manual Starter With Indicating Light

An improved manual starter, the Motor Sentinel Class 10-023, equipped with an indicating light to show when the motor is running, is available from the Westinghouse Electric Corporation, East Pittsburgh, Pa. Useful for starting and protecting small a.c. and d.c. motors used with fans, pumps, compressors and other industrial or domestic appliances, the starter is available as a double-pole switch with ratings up to 1 hp., 250 volts.

Quick-make quick-break action to insure rapid and positive operation is provided by an over-center, self-indicating toggle mechanism in this new motor starter. Positive bimetallic overload protection allows safe-capacity overloads, but automatically disconnects the motor on sustained or damaging overload. Proper selection of replaceable heater allows sufficient delay for small motor starting.

The device is housed in a N.E.M.A.

(Continued on page 90)



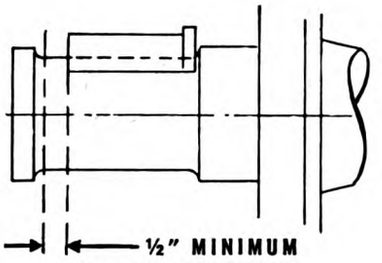
New GAEX-DF "DAMAGE-FREE" Box Cars

. . . give lading the smoothest, safest ride, on AAR Solid Journal Bearings

Here's a new type box car specially designed to give our railroads a bigger *net* return. It's "Damage Free" . . . no effort or expense spared by General American Evans to keep the lading safe . . . built to keep on the road, too, with high monthly mileage and quick, easy maintenance as essential requirements.

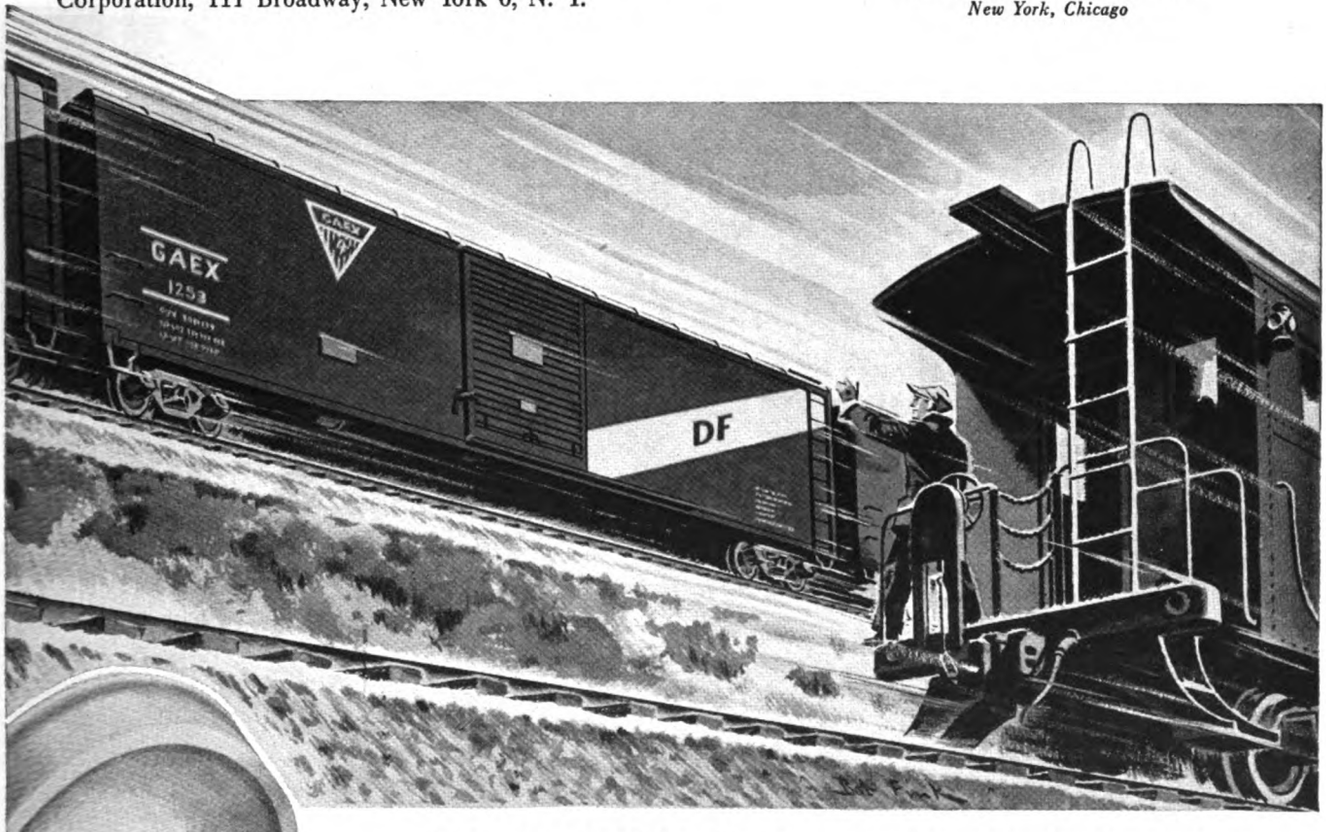
The journal bearings purchased for GAEX-DF cars are Magnus-made AAR solid-type bearings. That's because solid-type bearings are essentially "free-floating" on the journals — not only take but cushion shock thrust loads before they reach the car and lading. And you also get a greater potential in ton-miles per hour with minimum operating and upkeep costs.

For complete information on "D-F" cars write to the General American Evans Company, at 2842 W. Grand Blvd., Detroit 2, Michigan. And be sure to get your copy of "The FACTS About AAR Solid Journal Bearings" by writing to Magnus Metal Corporation, 111 Broadway, New York 6, N. Y.



That's why AAR solid bearings make car bodies last longer — give minimum wear on wheel flanges — and reduce the possibility of damage to lading.

MAGNUS METAL CORPORATION
Subsidiary of
NATIONAL LEAD COMPANY
New York, Chicago





Here's why AAR Solid Bearings have no equal for railroad rolling stock

MAXIMUM DEPENDABILITY: In high speed service, a record of 42,000,000 car miles without a "heating."

LOWEST ACCELERATING AND RUNNING RESISTANCE: Glides on a single film of oil, like a skater on ice.

EASE OF MAINTENANCE: Can be fully inspected or replaced on the line in about 10 minutes. No shopping required.

UNIVERSAL INTERCHANGEABILITY: Simple — dependable — economical — safe.

LIGHT WEIGHT: Saves many tons of excess dead weight on every moving train.

ROCK BOTTOM COST: Saves over 25% on initial *car* cost — 96% on bearing replacement.

GM Diesels are the best railroad security

In January 1941, railroads and heavy industries in the United States had in regularly scheduled service 621 units of General Motors Diesel locomotives.

Now the total is 9,000 GM Diesel units – and the number is growing daily as demands for this modern Diesel motive power increase.

Unmatched experience *on the rails* has demonstrated that dieselization with General Motors locomotives is the soundest investment railroads can make.

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS LA GRANGE, ILL.

Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ont.

(*Continued from paeg 86*)
type I enclosure suitable for general purpose application. Straight-through wiring and accessible front terminals allow easy installation and service. Made of die cast aluminum the enclosure is Bonderized and has a lustrous gray finish.

Horizontal Duplex Air Compressor

Utilization of roller bearings instead of conventional sleeve-type bearings in the running gear on the horizontal duplex compressor is a feature of the units developed by the Chicago Pneumatic Tool Company, New York 17.

Spherical roller main bearings support the crankshaft and are also used at the crank pin end of the connecting rod; double row needle bearings are used in the crankhead end of the connecting rod.

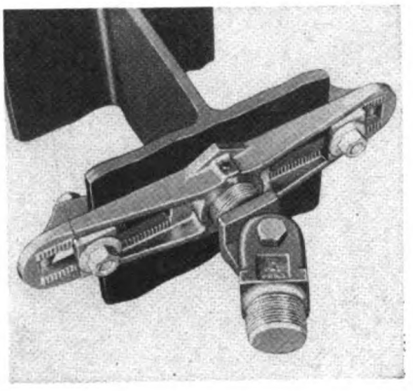
The recent development of the oil injection system of bearing removal, when applied to compressor bearings and crank discs, makes the application of roller bearings throughout practical.

These bearings are self-adjusting, and have a life expectancy equal to that of the compressor itself.

The oil injection system of bearing and crank disc installation or removal permits use of one-piece crank discs and connecting rods.

Bearing or crank disc removal and replacement can be accomplished with ordinary hand tools and a portable, hand-operated, hydraulic pump . . . no heavy pullers or presses are needed on the job.

A simple hydraulic pump is used in the oil injection method to inject oil between the bearing or crank disc and tapered shaft. The oil pressure expands the part inner bore and the oil film reduces friction between the parts as the pressure separates the contacting surfaces; this friction loss and resultant axial component of force causes the crank disc or bearing to pop off.

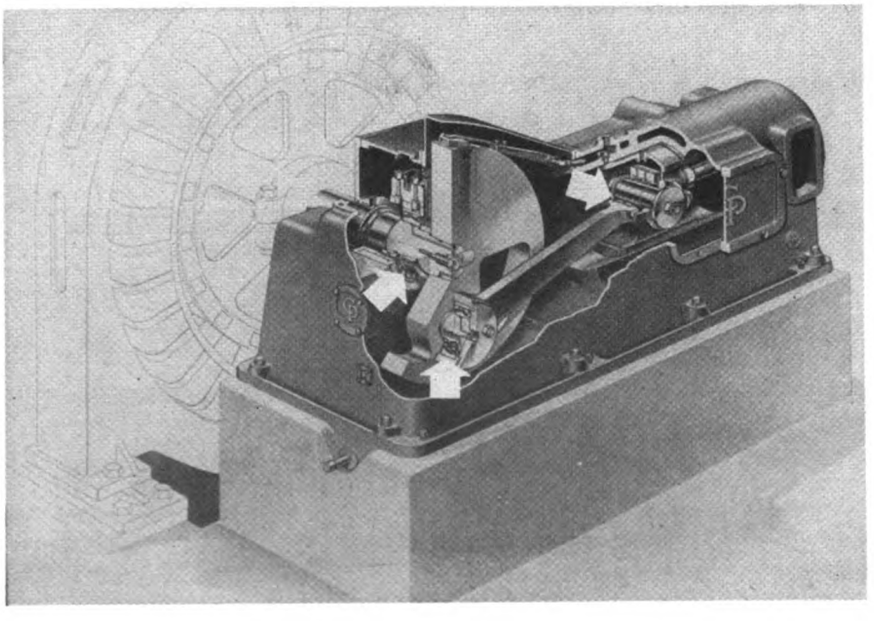


Adjustable Beam Clamp

The Thompson Electric Company, Cleveland, Ohio, announces the development and production of a heavy-duty, adjustable beam clamp which has been designed to suspend heaters, motor platforms, lighting fixtures, fans or blowers, conveyors, exhaust ducts, loudspeakers, and other types of overhead-mounted equipment from structural members of buildings. Featuring quick, easy attachment, this cast malleable iron beam clamp will support loads up to 1,500 lb. It is heavily cadmium plated for corrosion resistance.

The clamp can be attached to standard I, inverted T, or H beams, as well as trusses and girders consisting of angles or channels back-to-back. It will fit heavy structural members ranging from 4 to 8½ in. in width. Installation adjustment is accomplished by means of two bolts and nuts. In addition, the clamp is tapped for a 1¼-in. pipe thread connection.

The clamps can be equipped with a new adjustable angle fitting, as shown in the illustration, which provides for vertical suspension from sloping or arched roof members. The adjustable fitting also permits angle mountings from wall posts or columns.

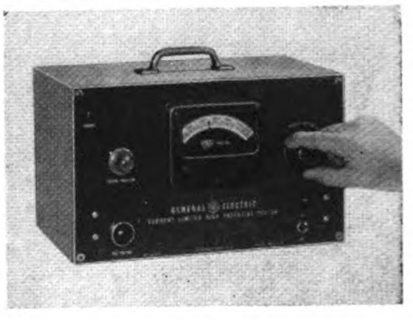


Hard Surface Plastic Covering

A vinyl plastic Naugahyde covering for use as a facing for hard surfaces in trains is in production according to an announcement made by the United States Rubber Company, New York 20.

The covering has a tough special backing which gives it stability in hanging. It can be applied with conventional adhesives on most hard surfaces. It has a smooth, fine textured grain and is resistant to abrasion, scuffing and gouging. This product will not become brittle or chip, retains its color and texture, and can be washed with soap and water.

The product is made in 30-yd. rolls, 50 in. wide. It is sold in 12 colors, including seven popular pastel shades and five deep tones. Special grains and colors are available on a made-to-order basis.



Instrument for Testing Insulating Materials

An instrument for electrical testing of insulating materials, the Current Limited High-Potential Tester, has been announced by the Special Products Division of the General Electric's Apparatus Department.

Developed by G. E. General Engineering and Consulting Laboratory, the instrument is designed to aid electrical manufacturing plants and service shops in testing insulation of electrical components and assemblies such as coils, relays, motors, and appliances. Special applications of the instrument have been made for detecting flaws in surface coatings of paint, lacquer, and sheet materials of a non-conducting nature.

The output current of the tester is limited to a value below the maximum value which an operator can let go if he should accidentally come in contact with the test probes. The low value of output current also assures non-destructive testing.

An indicating meter measures crest value of voltage on samples tested regardless of wave shape, internal voltage drop, or variation in line voltage. Faults are indicated by a glow lamp on the panel.

The indicating instrument reads the voltage across the equipment being tested and the measurement is not affected by impedance drops in the internal circuit of the tester. Overloading the tester does

(*Continued on page 108*)

"Tailor-made"

Esso Andok B

a better lubricant for better protection

THE IDEAL LUBRICANT—for all traction motor armature bearings... it has successfully performed in many anti-friction bearings in auxiliary equipment on passenger cars and locomotives.

ANDOK B GIVES 3-WAY SERVICE *when properly used* for important traction motor armature bearings:

1. Avoids overgreasing.
2. Avoids undergreasing.
3. Helps prevent introduction of dirt into bearings.

Bearings lubricated with famous Andok B can be completely sealed after overhaul... should run under ordinary use for 300,000 miles without further attention. For high-quality, long-lasting lubrication protection that saves on maintenance costs... specify Andok B!

BACKED BY CONSTANT RESEARCH—continuing tests *in the lab* and *on the road* make certain that Andok B keeps pace with progress and latest railroad lubrication needs.

BACKED BY CONSTANT FOLLOW-UP—on-the-job check-ups by Esso Sales Engineers watch the dependable performance of Esso Railroad fuel and lubricants. Be sure to call on Esso for any railroad fuel or lubricating problems.

The Sign of QUALITY — Esso — *The Symbol of* SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.



NEWS

A.A.R. Mechanical Division Circulars

"Home for Repairs" Notation Omitted

An A.A.R. Mechanical Division circular, dated December 13, calls attention to unnecessary delays to damaged cars moving homeward for repairs because defect cards attached fail to carry the notation "Home for Repairs", as specified in Interchange Rule 4. In such cases, it is frequently necessary for the receiving road to shop the car and see if all existing damage is fully covered by the items listed on the defect cards. Invariably, additional unconcealed associated damage is found to exist, and the car is delayed while steps are taken to procure additional defect-card protection from the delivering line or from the road which issued the defect cards attached to the car.

Where the damage is slight and can easily be fully covered by a defect card, it is not necessary to include this notation. However, where the damage is more or less extensive and it cannot readily be determined that all delivering line defects are fully covered, it is then advisable to include the notation "Home for Repairs" on the defect card.

In the interest of reducing delays at interchange points, the circular urges that all forces authorized to issue defect cards be instructed to place this notation on cards where necessary.

Three Roller Bearing Lubricants Approved

In a recent circular, the following were approved as of December 13, 1950, by the Committee on Lubrication of Cars and Locomotives for lubricating the journal roller bearings of passenger equipment cars which move in interchange service: Lubrico M-1, special, Master Lubricants Company; H-927 non-fluid oil, New York and New Jersey Lubricant Company; No. 979 roller bearing grease, Texas Company.

This subject is receiving further study by the Committee on Lubrication of Cars and Locomotives.

Road Service Tests of Laudig Bearings

The A.A.R. Mechanical Division has recently authorized service tests of 100 cars equipped with Laudig iron-back journal bearings in interchange service. In order that full benefits from these tests may be realized, detailed instructions have been given regarding application of the bearings, condition of wedges and box roofs, bearing marks, stenciling and records.

The A.A.R. circular pertaining to Laudig bearings, dated November 30, lists six cars on the Pennsylvania and ten cars on the New York Central as already equipped with these bearings, other installations being scheduled for cars of the Baltimore & Ohio; Deleware, Lackawanna & Western; Denver & Rio Grande Western; and Norfolk & Western. The circular requested prompt return of any test bearings which develop defects to specified officers on the individual roads. Associated axles with journals damaged by contact with the iron back of the Laudig bearings are also to be returned, as this type of information is specifically desired.

Electrical Section Elects Officers

The Electrical Section, Engineering Division, Association of American Railroads, has announced its officers for 1951, including three new members of the Committee of Direction, elected for a three-year term.

The present slate of officers is as follows: chairman—H. F. Finnemore, chief electrical engineer, Canadian National, Montreal, Canada; vice-chairman—C. A. Williamson, electrical engineer, Texas & New Orleans, Houston, Tex.; secretary—N. D.

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

Freight Service (Data from I. C. C. M-211 and M-240)

Item No.		Month of September 1950	Month of September 1949	Nine months ended with September 1950	Nine months ended with September 1949
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	30,717	29,134	255,502	303,130
3-06	Total, Diesel-electric	18,492	13,030	152,690	109,390
3-07	Total, electric	859	726	7,386	7,297
3-04	Total, locomotive-miles	50,075	42,896	416,624	419,830
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,792	1,462	14,320	13,478
4-06	Empty, total	885	764	7,518	7,737
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	53,690	45,466	425,168	482,464
6-02	Total in oil-burning steam locomotive trains	14,299	14,085	113,127	133,532
6-03	Total in Diesel-electric locomotive trains	53,419	37,468	432,902	313,484
6-04	Total in electric locomotive trains	2,338	1,918	19,578	19,694
6-06	Total in all trains	123,775	98,959	990,984	949,262
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.05	1.05	1.06
10-02	Loaded freight car-miles	40.1	38.1	38.4	36.1
10-03	Empty freight car-miles	19.8	19.9	20.2	20.8
10-04	Total freight car-miles (excluding caboose)	59.9	58.0	58.6	56.95
10-05	Gross ton-miles (excluding locomotive and tender) (000)	2,769	2,578	2,660	2,549
10-06	Net ton-miles (000)	1,296	1,152	1,211	1,14
12	Net ton-miles per loaded car-mile (M-211)	32.3	30.2	31.5	31.8
13	Car-mile ratios (M-211)	73.4	75.1	72.5	71.4
13-03	Per cent loaded of total freight car-miles	66.9	65.7	65.6	63.5
14	Averages per train hour (M-211):				
14-01	Train miles	16.7	17.0	16.9	16.9
14-02	Gross ton-miles (excluding locomotive and tender) (000)	45,555	43,178	44,422	42,411
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	48.8	40.7	44.7	42.2
14-02	All	46.1	38.1	41.7	39.8
15	Average net ton-miles per freight car-day (000) (M-240)	998	756	862	804
17	Per cent of home cars of total freight cars on the line (M-240)	35.8	49.7	42.4	50.4

Passenger Service (Data from I. C. C. M-213)

3	Road motive-power miles (000):				
3-05	Steam	11,913	14,088	105,280	144,218
3-06	Diesel-electric	15,052	12,863	130,236	112,416
3-07	Electric	1,602	1,559	14,409	14,938
3-04	Total	28,568	28,509	249,926	271,685
4	Passenger-train car-miles:				
4-08	Total in all locomotive-propelled trains	297,578	272,679	2,408,620	2,538,835
4-09	Total in coal-burning steam locomotive trains	63,492	73,790	541,704	755,860
4-10	Total in oil-burning steam locomotive trains	38,481	41,672	332,448	401,031
4-11	Total in Diesel-electric locomotive trains	160,230	140,195	1,379,438	1,218,804
12	Total car-miles per train-miles	9.64	9.37	9.44	9.16

Yard Service (Data from I. C. C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,457	1,464	12,689	16,425
1-02	Steam, oil-burning	273	240	2,180	2,496
1-03	Diesel-electric[1]	2,659	2,066	22,017	17,688
1-06	Total	4,419	3,796	37,129	36,845
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	49	76	527	839
2-02	Steam, oil-burning	14	14	119	142
2-03	Diesel-electric[1]	234	212	2,037	1,858
2-06	Total	332	336	2,988	3,154
3	Hours per yard locomotive day:				
3-01	Steam	8.7	7.3	7.9	8.3
3-02	Diesel-electric	17.9	17.3	17.3	17.4
3-05	Serviceable	14.7	13.3	14.0	13.4
3-06	All locomotives (serviceable, unserviceable and stored)	12.7	10.8	11.8	11.2
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.71	1.80	1.79	1.89
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.74	0.77	0.77	0.77

[1] Excludes B and trailing A units.



Nothing could be Simpler, or Better, than this One-Piece Cast-Steel Beam

Stronger, lighter, one-piece construction makes A.S.F. Cast-Steel Unit Brake Beams ideal for all freight equipment. Heads are permanent, integral parts. They do not depend upon laps, welds, joints, or rivets for rigidity and proper alignment.

Today, after more than three years' use, there's not a single case on record of structural failure or of maintenance due to normal wear. Want more facts about these money-saving, long-lasting brake beams? Ask your A.S.F. Representative.

A.A.R. Approved. Certificate No. 54.

AMERICAN STEEL FOUNDRIES

MINT MARK OF ○ FINE PRODUCTS

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE JANUARY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horse-power	Service	Builder
Central of New Jersey	14[1]	1,600	General utility	Alco-G. E.
	1	1,000	Road switch	Alco-G. E.
	9	1,200	Switching	Electro-Motive
	7	1,200	Switching	Baldwin-Lima-Hamilton
Illinois Central	4	2,250	Passenger	Electro-Motive
	3	1,500	Switching	Electro-Motive
	35	1,200	Switching	Electro-Motive
	2	600	Switching	Electro-Motive
Missouri-Kansas-Texas	5	2,250	Passenger	Electro-Motive
	4	1,600	Road switch	Fairbanks, Morse
	2	1,600	Road switch	Alco-G. E.

GAS-TURBINE-ELECTRIC LOCOMOTIVE ORDERS

Union Pacific	10[2]	4,500	Freight	General Electric

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Cuyahoga Valley	100[3]	70-ton gondola	Magor Car
Lehigh & New England	500	50-ton hopper	American Car & Fdry.

PASSENGER-CAR ORDERS

Road	No of cars	Type of car	Builder
Missouri Pacific	4	Planetarium dome	Pullman-Standard
Texas & Pacific	1	Planetarium dome	Pullman-Standard

[1] Fall delivery expected.
[2] See page 72 of the January issue for a brief description of these locomotives.
[3] Delivery scheduled for July.

NOTES:

Bangor & Aroostook.—The B. & A. has been authorized to acquire 500 new refrigerator cars at a cost of $4,500,000. This equipment, to be purchased from contract builders or built at the road's Derby, Me., shops, is in addition to 500 refrigerator cars being rebuilt at Derby at a $1,500,000 cost, and 300 box "heater cars" recently delivered by the Magor Car Corporation at a cost of $2,100,000.

Northern Pacific.—Northern Pacific has announced that its 1951 improvement program calls for purchase of six 6,000-hp. diesel freight locomotives and three 1,500-hp. diesel road-switchers, the construction of 500 box cars and 100 covered hoppers at the company's Brainerd, Minn., shops, and the purchase from suppliers of 250 gondolas, together with the continuance of heavy repair and maintenance of cars. The order for 250 gondolas was announced in the December, 1950, issue.

Texas & Pacific.—The T. & P. has been authorized to purchase 34 diesel-electric locomotive units, as follows: Six 3-unit 4,500-hp., four 2-unit 3,000-hp. and one 1,500-hp. freight locomotives; two 1,500-hp. road-switching units and five 1,200-hp. switching units.

Howard, Electrical Section, Engineering Division, A.A.R., Chicago; assistant secretary—Frank McNellis, Electrical Section, Engineering Division, A.A.R., Chicago.

Committee of Direction; L. S. Billau, electrical engineer, Baltimore and Ohio, Baltimore, Md.; S. R. Negley, electrical engineer, Reading, Philadelphia, Pa.; John Leisenring, electrical superintendent, Illinois Terminal, Springfield, Ill.; H. F. Finnemore, chief electrical engineer, Canadian National, Montreal, Canada; K. H. Gordon, assistant electrical engineer, Pennsylvania, Philadelphia, Pa.; C. A. Williamson, electrical engineer, Texas & New Orleans, Houston, Tex.; H. F. Brown, electrical engineer, New York, New Haven & Hartford, New Haven, Conn.; H. A. Hudson, signal and electrical superintendent, Southern, Cincinnati, Ohio, and P. B. Burley, superintendent of communication and electrical engineer, Illinois Central, Chicago, Ill.

Miscellaneous Publications

SAFETY IN ELECTRIC AND GAS WELDING AND CUTTING OPERATIONS. AMERICAN WELDING SOCIETY, 33 West 39th Street, New York 18, or American Standard Association, 70 East 45th Street, New York 17. 42 pages, 6 in. by 9 in., paper covered. Price, 50 cents. American Standard Z49.1, prepared by a committee sponsored by the American Welding Society under the procedures of the American Standard Association, covers regulations for the safe installation and operation of welding equipment for all arc, gas and resistance welding processes. Provisions are included for fire prevention and protection in regularly assigned welding areas as well as in other locations. Eye protection and clothing requirements, health protection, etc., are prescribed both for the welder and other nearby workers. Precautions are specified for the welding of materials which may give off toxic fumes and for welding in confined spaces. Ventilation requirements are also stressed.

SUPPLY TRADE NOTES

BALDWIN-LIMA-HAMILTON CORPORATION. —*George H. Lynn*, who has been appointed general sales manager of the Hamilton division of the Baldwin-Lima-Hamilton Corporation, as announced in the January issue, joined the Lima-Hamilton Corporation in 1947 as western district manager in Chicago for the Niles tool works division and the Hooven, Owens. Rentschler division. Prior to joining Lima-Hamilton he was with the sales department of the Westinghouse Electric Corporation from 1933 to 1939. He next became eastern representative for the Axelson Manufacturing Company of Los Angeles, Cal., connected with the sales department of the lathe division. At the time Mr. Lynn left to join Lima-Hamilton he was special assistant to the president of the Los Angeles company.

—*John D. Dickinson*, formerly manager of locomotive sales of the Lima-Hamilton Corporation, at New York, has been appointed assistant district manager of the New York district office of the successor Baldwin-Lima Hamilton Corporation. Mr. Dickinson has been associated with Lima-Hamilton since 1927.



J. D. Dickinson

SHIPPERS' CAR LINE CORPORATION.—*Harry J. Leddy* has been elected executive vice-president of the Shippers' Car Line Corporation, subsidiary of the American Car & Foundry Co. *John B. Davenport* has been named vice-president in charge of sales.

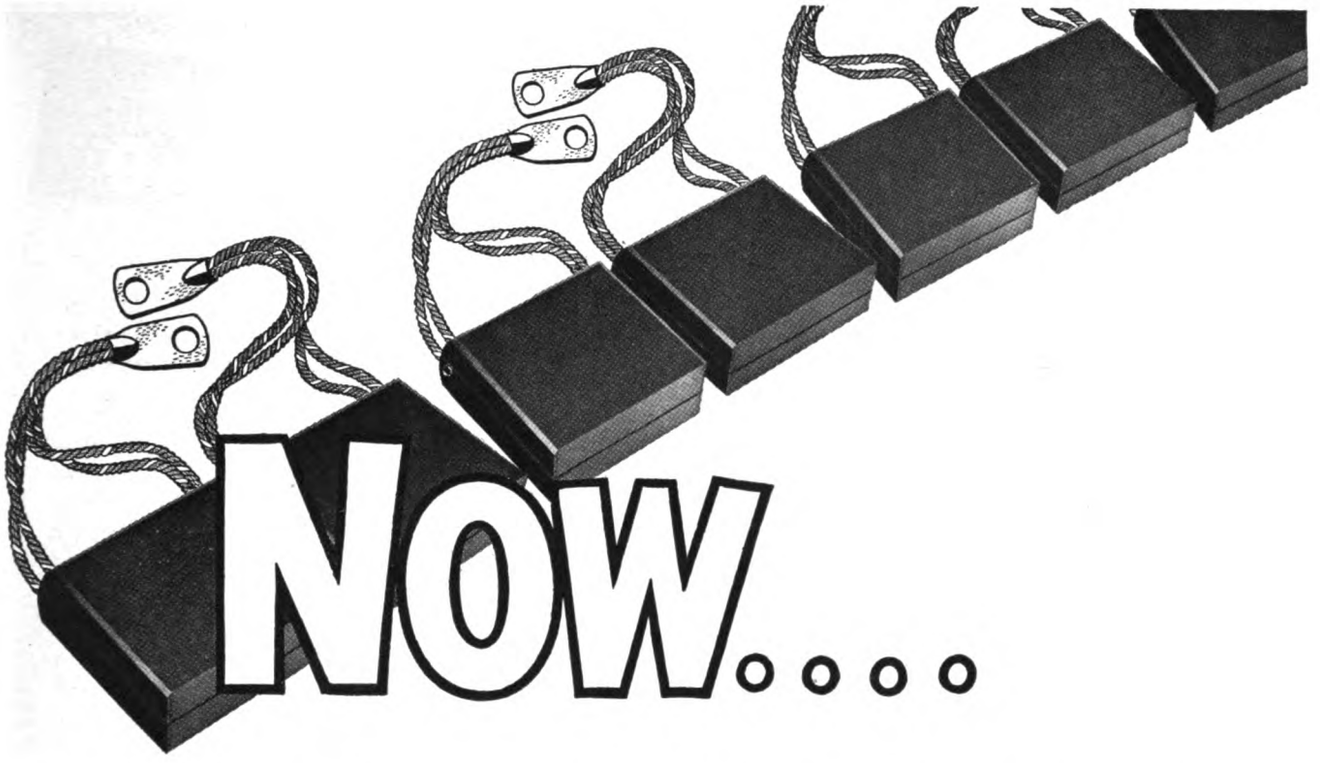
◆

MACLEAN-FOGG LOCK NUT COMPANY.—*Ernest G. Doke*, assistant to the president, and *Joseph J. Murphy*, manager of sales, of the MacLean-Fogg Lock Nut Company have been named vice-presidents, with offices as before, in Chicago.

◆

CANADIAN RAILROAD SERVICE COMPANY. —*Joseph V. Condon* has been appointed assistant to Vice-President H. V. Gigandet of the Canadian Railroad Service Company, a unit of the Union Carbide & Carbon Corp., with headquarters at Toronto, Ont. Mr. Condon's railroad experience started with the Canadian National in 1928. He

(*Continued on page 98*)



NOW....

NATIONAL standardized brushes!

TRADE-MARK

Biggest advance in 50 years of industrial brush selling

● Here is a tremendous advance in industrial brush selling. National Carbon has set up a list of diesel-electric locomotive brushes — for generators, traction motors and auxiliary equipment — which effectively covers the field. These brushes are the best ever made for this equipment. They will give you top performance. And you can get them at a *low, flat* price — regardless of quantity — so long as you order at least one box of brushes. You get the brushes quickly. They are kept in stock. Finally, you get the brushes in a sturdy, durable box. You get *better brushes*...at a *better price*...in a *better package.*

NATIONAL CARBON DIVISION
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

Please send me complete information on National Carbon's new brush-standardization listings.

*Name*_____

*Street*_____

*City*_____ *State*_____

The term "National" is a registered trade-mark of

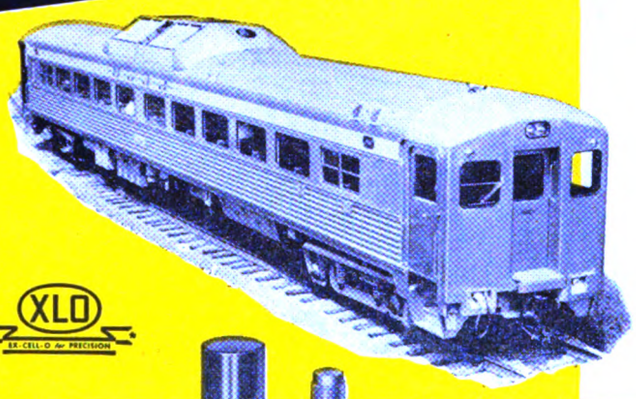
NATIONAL CARBON DIVISION
UNION CARBIDE AND CARBON CORPORATION
30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

In Canada: National Carbon, Ltd., Toronto 4

GOING PLACES . . .

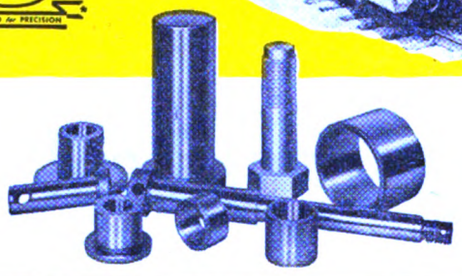
BUDD RAIL DIESEL CARS WITH PINS AND BUSHINGS BY EX-CELL-O



An outstanding feature of the new Budd RDC Rail Diesel Car is the Budd disc brake. By eliminating direct wheel contact, this brake increases wheel life; decreases maintenance.

Ex-Cell-O pins and bushings are used throughout the Budd disc brakes on the RDC. The choice was a natural one—for Ex-Cell-O pins and bushings consistently wear better; last longer. Records of more than a million miles of service between shoppings are not unusual.

For your new or reconditioned equipment, standardize on Ex-Cell-O pins and bushings. Sizes for steam and Diesel equipment are listed in Ex-Cell-O Catalog 32381. For your free copy, write Ex-Cell-O Corporation today on your company letterhead.



Railroad Division

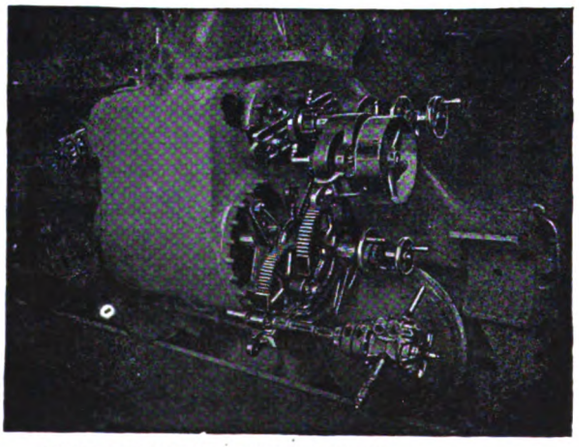
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

50-33

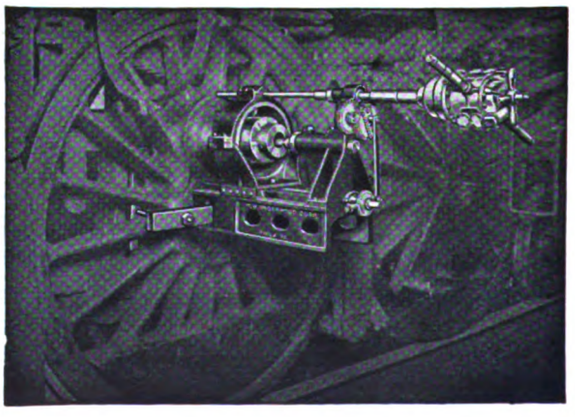
UNDERWOOD PORTABLE MACHINE TOOLS

For Railway Shops and Engine Houses



Left: The Underwood Boring Bar illustrated is designed for reboring all sizes of locomotive cylinders and valve chambers.

Below: The Underwood Portable Crankpin Turning Machine returning crankpin in position.



OTHER UNDERWOOD TOOLS:

- Portable Facing Arms
- Rotary Planing Machines
- Locomotive Cylinder or Dome Facing Machine
- Portable Pipe Benders
- Rotary Flue Cleaner

H. B. UNDERWOOD CORPORATION, PHILADELPHIA 23, PA., U. S. A.

We honor a great railroad and are proud that Scullin Freight Car Castings have played a part in the progress of Illinois Central during the past half century



SCULLIN STEEL CO.
SAINT LOUIS 10, MISSOURI

NEW YORK
CHICAGO
CLEVELAND
BALTIMORE
RICHMOND, VA.

(*Continued from page 94*)

became associated with Canadian Railroad Service in 1941 and was supervisor of maintenance of way at thee time of his appoint ment as assistant to vice-president.

◆

JOSEPH T. RYERSON & SON.—*Charles L. Hardy*, formerly assistant to the president, has been elected president of Joseph T. Ryerson & Son, to succeed *Everett D. Graff*, who has become chairman of the executive committee. *Thomas Z. Hayward*, formerly general manager of sales for the 13 Ryerson steel service plants, has been elected vice-president in charge of sales.

◆

GENERAL ELECTRIC COMPANY.—*Ralph J. Cordiner*, executive vice-president of the General Electric Company since 1949, has been elected president to succeed *Charles E. Wilson*, recently named chairman of the Defense Mobilization Board.

Mr Cordiner has been associated with G.E. for 24 years. During that period he



R. J. Cordiner

served as manager of five of the company's departments, and had been executive vice-president since 1949. He has been continuously connected with the electrical industry since his undergraduate days at Whitman College in Walla Walla, Wash., his birthplace. His first position was on a part-time basis with the Pacific Power & Light Co. In 1922 he was made commercial manager of a division of Pacific Power & Light. In less than a year he was offered a position with the Edison General Electric Appliance Company with headquarters in Portland Ore. Five years later he became northwest manager there and in 1930 moved to San Francisco, Cal., to become Pacific Coast division manager. When the heating device section of Edison General Electric Appliance was transferred from Chicago and consolidated with G. E.'s appliance and merchandise department at Brideport, Conn., in 1932, Mr. Cordiner went with the section as manager and chairman of the management committee. Two years later he was appointed assistant manager of appliance sales and in 1935 became manager of the radio division. A year later he was promoted to assistant manager of the appliance and merchandise department and in January, 1938, to manager of the department. In 1942 Mr. Cordiner entered government service as director general of war production scheduling and vice-chairman of the War Production Board. He rejoined G.E. as assistant to the president in 1943 and was elected vice-president in 1945.

◆

SAFETY CAR HEATING & LIGHTING CO.—*Henry A. Sperry* has been appointed sales representative in the St. Louis, Mo., office



H. A. Sperry

of the Safety Car Heating & Lighting Co. Mr. Sperry was previously in the company's engineering department at New Haven, Conn.

◆

STANDARD RAILWAY EQUIPMENT COMPANY.—*J. E. Vaughn* has been elected vice-president in charge of sales of the Standard Railway Equipment Manufacturing Company, with jurisdiction over sales in the United States and Canada. *S. L. Beymer* has been elected vice-president and executive assistant to the president.

◆

UNION ASBESTOS & RUBBER CO.—*A. F. O'Connor* has been appointed manager of the "Equipco" hand brake department of the Union Asbestos & Rubber Co. Mr. O'Connor was formerly sales manager. In his new position he will be in charge of sales, product development, engineering and manufacturing. This department will embrace all metallic items for railroad equipment, except "Equipco" refrigerator car specialties.

◆

COOPER - BESSEMER CORPORATION. — *Charles G. Cooper*, manager of the Washington, D. C., office of Cooper-Bessemer, has been elected a vice-president.

◆

AJAX-CONSOLIDATED COMPANY.—*R. L. Clark* has been appointed sales engineer for the Ajax-Consolidated Company, with headquarters in the First National Bank building, St. Paul, Minn.

◆

CHERRY RIVET COMPANY, DIVISION OF TOWNSEND COMPANY.—*F. R. Dickenson*, president of the Townsend Company, has announced completion of a merger of his firm and the Cherry Rivet Company of Los Angeles, Cal. The latter will operate as the Cherry River Company, division of Townsend Company. *William B. Hubbard*, former president of Cherry Rivet, has been elected to the Townsend board of directors and will be managing director of the Cherry Division. The merger was effected by an exchange of 6½ shares of Cherry Rivet stock for each share of Townsend.

◆

UNITED STATES RUBBER COMPANY.—*Edwin D. Meade*, formerly manager of western railway sales of the United States Rubber Company, has been appointed district sales manager, Chicago branch, succeeding *Joseph A. Conlon*, who has been appointed manager of allied sales for the mechanical goods division, at New York.

Mr. Meade joined U. S. Rubber as a clerk in the New York branch in 1935. He entered mechanical goods sales a year later and, in 1941, became a special representative of the war products division, at Washington, D. C. He was transferred to Chicago as manager of western railway sales in 1947. Mr. Conlon joined U. S. Rubber in June, 1930, as a salesman in the Los Angeles, Calif., branch. He advanced through various sales and merchandising positions until 1945, when he was appointed assistant district sales manager of the mechanical goods division's Chicago branch. In September, 1949, he became district sales manager at Chicago. The United States Rubber Company has purchased from the Esso Standard Oil Company the latter's Buna-N synthetic rubber plant in Baton Rouge, La. The plant will be operated by the Naugatuck chemical division of the rubber company, which will continue to market Buna-N rubber under the trade name Paracril.

◆

CULLEN-FRIESTEDT COMPANY.—*H. M. McFarlane* has been appointed sales manager



H. M. McFarlane

of the Cullen-Friestedt Company at Chicago. Mr. McFarlane is president of the National Railway Appliances Association.

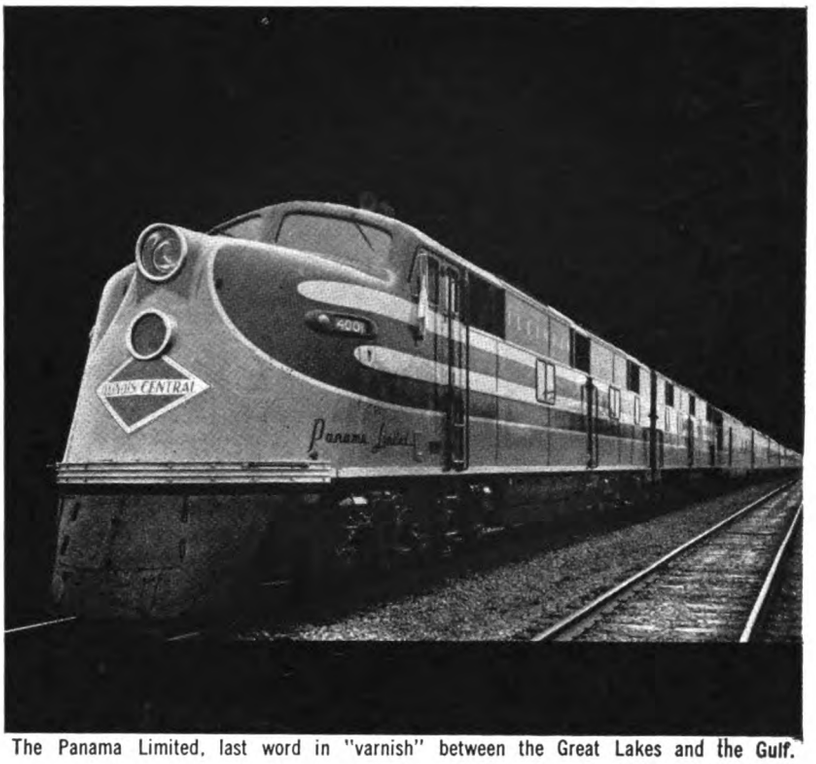
◆

WESTINGHOUSE ELECTRIC CORPORATION.—*A. M. Harrison* has been appointed manager of the DC Engineering Department of the Transportation and Generator Division of the Westinghouse Electric Corporation at East Pittsburgh, Pa. Mr. Harrison was

WELCOME

ILLINOIS CENTRAL

TO THE CENTURY CLUB



The Panama Limited, last word in "varnish" between the Great Lakes and the Gulf.

A salute to the Illinois Central from the makers of

PENNSALT MAINTENANCE CLEANERS

This year marks the centennial celebration of the Main Line of Mid-America. Pennsalt, itself just turned 100, congratulates the Illinois Central on 100 years of successful railroading.

Progressive railroading, too! Progressive in fast, dependable freight service, such as that rendered Pennsalt at its new Calvert City, Ky., plant. Progressive in passenger service, typified by the all-Pullman Panama Limited.

Progressive in maintenance, too, where Pennsalt cleaning compounds have been selected for cleaning steam locomotive frames, trucks and running gear . . . as well as Diesel engine blocks and trucks.

Illinois Central has found that Pennsalt Cleaners give fast, efficient cleaning on a wide variety of parts. Solutions last longer, and, because Pennsalt alkaline cleaners are virtually anhydrous, they can be used in lower concentrations.

Not only on the Illinois Central, but on many other major roads Pennsalt Cleaners are delivering that extra "something" in cleaning efficiency. Your local Pennsalt representative will be glad to study your maintenance cleaning operations, and help set up tests to prove the advantages of Pennsalt Cleaners. Write: Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

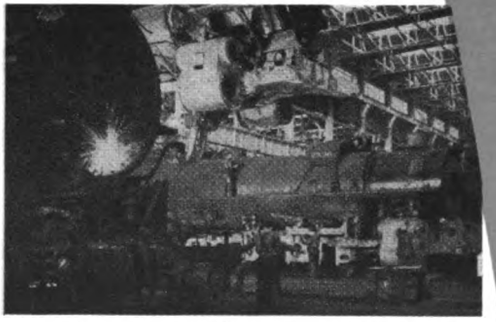
PENN SALT

Railroad Maintenance Cleaners

PROGRESSIVE CHEMISTRY FOR OVER A CENTURY



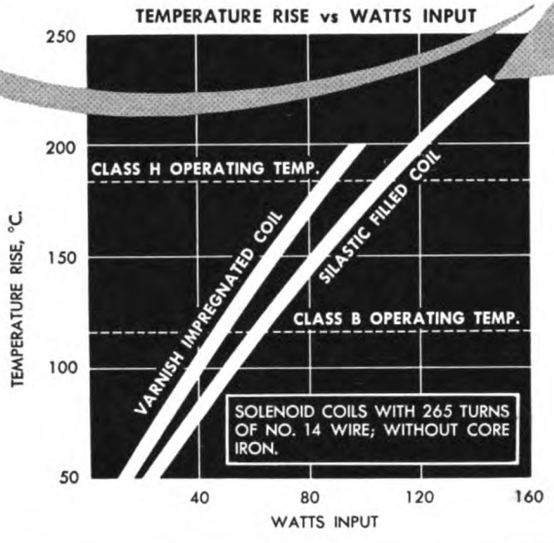
One of the Illinois Central fast freights which speed merchandise from the head to the toe of America.



Shops at Paducah, Ky., where Pennsalt Cleaners give fast efficient removal of soil, keep locomotives on the high iron.

Photographs courtesy Illinois Central Railroad

SILASTIC* the resilient dielectric, stable from -60° to +200°C.

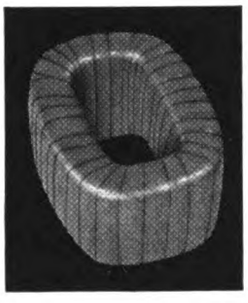


dissipates heat much faster than conventional insulating materials

Here's an insulating material that gives you all of the advantages of a rubberlike dielectric *at Class H temperatures,* plus extreme low temperature flexibility, plus about twice the thermal conductivity of conventional resinous or rubbery dielectrics! In a solenoid coil, for example (see graph above), Silastic gives 15% more capacity than resinous silicone insulation at 180°C. That's due to increased thermal conductivity alone.

Thermal stability plus high heat conductivity permit the Silastic coil to operate at 166% of the maximum capacity for an identical organic resin impregnated solenoid. Performance of over 1600 Silastic insulated main and interpole field coils in diesel-electric traction motors is further proof of the extraordinary advantages of Silastic as a dielectric.

In coils of all kinds, Silastic provides resiliency and relatively constant dielectric properties of temperatures ranging from below −60° to above 200°C., maximum resistance to corona, to electrical and mechanical fatigue and to abrasion, oil and outdoor weathering.



Silastic insulated solenoid has 166% of the capacity of identical Class B coil plus maximum shock, abrasion and vibration resistance over a span of 260 Centrigrade degrees from −60 to +200°C.



SEND TODAY! **For data on the properties, performance and applications for Silastic.**

(*T. M. Reg. U. S. Pat. Off.)

from +500°F. SILASTIC stays Elastic to −100°F.

DOW CORNING CORPORATION, DEPT. S-2, MIDLAND, MICH.

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Company _____

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Dow Corning

FIRST IN SILICONES

Atlanta • Chicago • Cleveland • Dallas • Los Angeles • New York • Washington, D. C.
In Canada: Fiberglas Canada Ltd., Toronto • In Great Britain: Midland Silicones, Ltd.

previously manager of the d.c. machine section of the DC Engineering Department.

◆

CUMMINS ENGINE COMPANY.—*Charles J. Wilhite* has been appointed acting northwest regional manager of the Cummins



C. J. Wilhite

Engine Company, with headquarters at 809-810 Security building, Seattle, Wash. *Ralph J. Shields* succeeds Mr. Wilhite in the position of northwest regional service representative.

◆

HENRY DISSTON & SONS.—*L. W. Jander* has been appointed sales manager of the industrial division of Henry Disston &

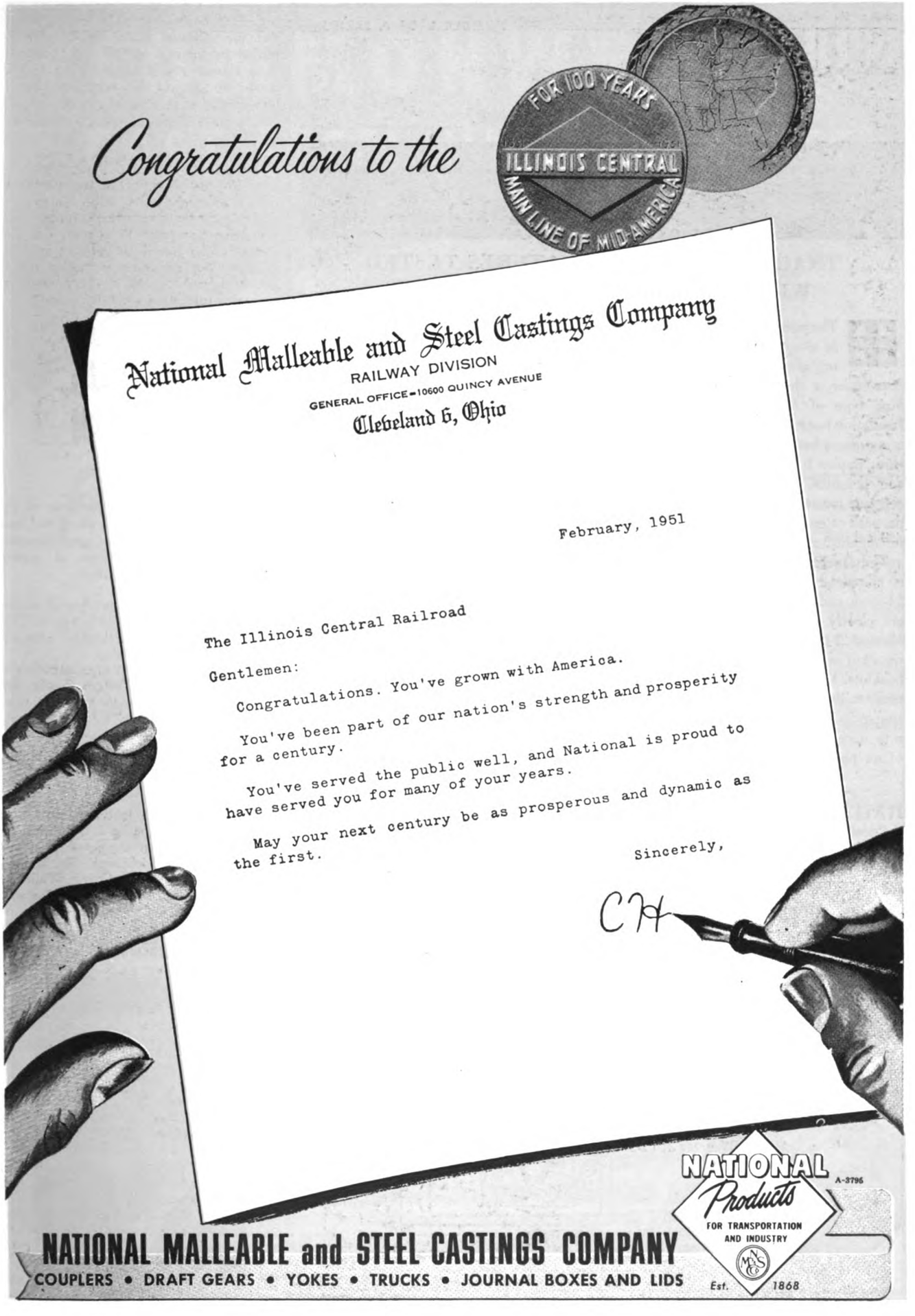


L. W. Jander

Sons. Mr. Jander succeeds *J. F. Wilkinson,* resigned. Mr. Jander has been in charge of eastern sales division operations since 1947.

◆

UNITED STATES STEEL CORPORATION.—A new steel plant, which will have the capacity to produce 1,800,000 ingot tons of steel a year for national defense and essential civilian uses, will be constructed near Morrisville, Pa., by the United States Steel Corporation. The plant, to be named the Fairless Works in honor of the company's president, Benjamin F. Fairless, will produce a wide range of finished products, including bars, standard steel pipe, wire rods, hot and cold rolled sheets and strip, and tin plate. Construction is ex-


Congratulations to the
FOR 100 YEARS
ILLINOIS CENTRAL
MAIN LINE OF MID-AMERICA
National Malleable and Steel Castings Company
RAILWAY DIVISION
GENERAL OFFICE-10600 QUINCY AVENUE
Cleveland 6, Ohio
February, 1951
The Illinois Central Railroad
Gentlemen:
Congratulations. You've grown with America.
You've been part of our nation's strength and prosperity for a century.
You've served the public well, and National is proud to have served you for many of your years.
May your next century be as prosperous and dynamic as the first.
Sincerely,
CH
NATIONAL
Products
FOR TRANSPORTATION AND INDUSTRY
M&S&C
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A-3796
NATIONAL MALLEABLE and STEEL CASTINGS COMPANY
COUPLERS • DRAFT GEARS • YOKES • TRUCKS • JOURNAL BOXES AND LIDS

BIDDLE

NUMBER 3 OF A SERIES

Instrument News

JAMES G. BIDDLE CO., 1316 ARCH ST.
PHILADELPHIA 7, PA.
ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

TRACTION MOTOR ARMATURES TESTED WITH CONVENIENT PORTABLE KIT

The portable test kit shown here, in use on the Santa Fe Railway, includes a Ducter Low Resistance Ohmmeter, a Biddle Power supply and a Meg type of Megger Rectifier-Operated Insulation tester. The bar-to-bar test on the armature is being made with the Ducter, using duplex hand spikes having a current and potential spike in each handle. In general, bar-to-bar tests are more for the purpose of equalizing the resistances than for measuring their exact values.

The Ducter Low Resistance Ohmmeter is completely discussed in our Bulletin 24-25-X and its operation and application are clearly described in our Instruction Manual 23J25-X. If you send us a request, we shall promptly mail you both of these booklets. Reading them will reveal why so many railway electrical men rely on rugged, simple-to-use Ducter equipment for accurate measurements down to a millionth of an ohm.

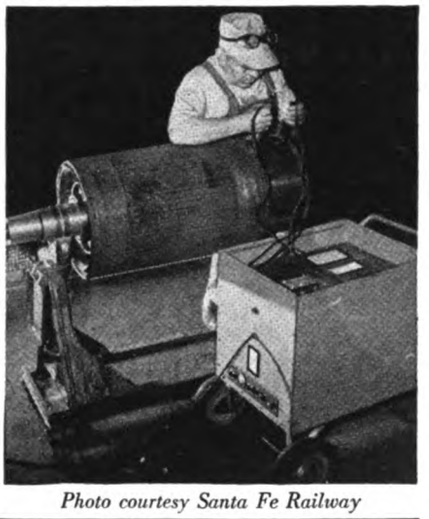


Photo courtesy Santa Fe Railway

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up-to-date.

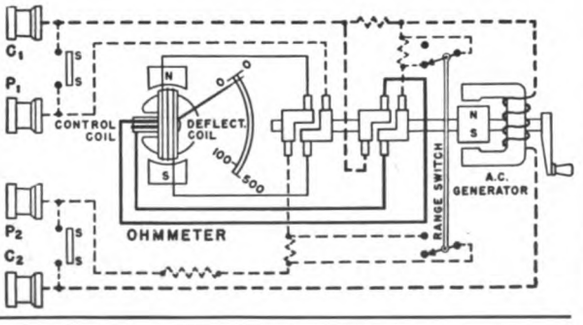
RAILROAD MEN SAY GROUND TESTING IS SIMPLIFIED

with the New CVM Type Megger® Ground Tester

Introduced in 1950, the CVM Type Megger Ground Tester is becoming a popular instrument with railroad signal and electrical maintenance engineers. Modern designing makes possible a lower cost. Weight is only 6 pounds. Dimensions are 7½" x 5" x 5¾". It is a completely self-contained test set with its own generator for supplying test current—no dependence on batteries or other current supply.

Here is an easy-to-use field instrument for determining if the resistance to earth of man-made grounds is sufficiently low to minimize dangers due to lightning. You can learn more about it by sending for Bulletin 25-80-X.





pected to begin early this coming spring and the structure is scheduled for completion by the end of 1952. The National Tube Company will operate the pipe producing portion of the new plant, while the remainder of the Fairless Works will be operated by the United States Steel Company.

◆

DUFF-NORTON MANUFACTURING COMPANY —*T. W. Krueger* has been appointed general sales manager of the Duff-Norton Manufacturing Company, Pittsburgh, Pa. Mr. Krueger, who joined Duff-Norton in 1947 as advertising and sales promotion manager, will continue to direct advertising and sales promotion activities.

PERSONAL MENTION

General

H. G. DUGAN, master mechanic of the Toledo Terminal at Toledo, Ohio, has been appointed superintendent of operations and motive power. The position of master mechanic has been abolished.

E. E. GLEASON, superintendent of motive power of the Western Pacific has had his title changed to chief mechanical officer.

E. T. CUYLER, assistant superintendent of motive power of the Western Pacific, has had his title changed to assistant chief mechanical officer.

IVAN S. GIBB has been appointed superintendent motive power and equipment of the Donora Southern at Donora, Pa.

JOHN E. MCLEOD, superintendent motive power of the Chesapeake & Ohio at Richmond, Va., has been appointed chief mechanical officer at Richmond. Mr. McLeod was born in Rockville, Conn. While attending McGill University at Montreal, Que., where he took a special course in railroad transportation, he worked summers as a special apprentice on the Cana-



J. E. McLeod

AN IMPORTANT CONTRIBUTION

COMMONWEALTH

CAST STEEL UNDERFRAMES

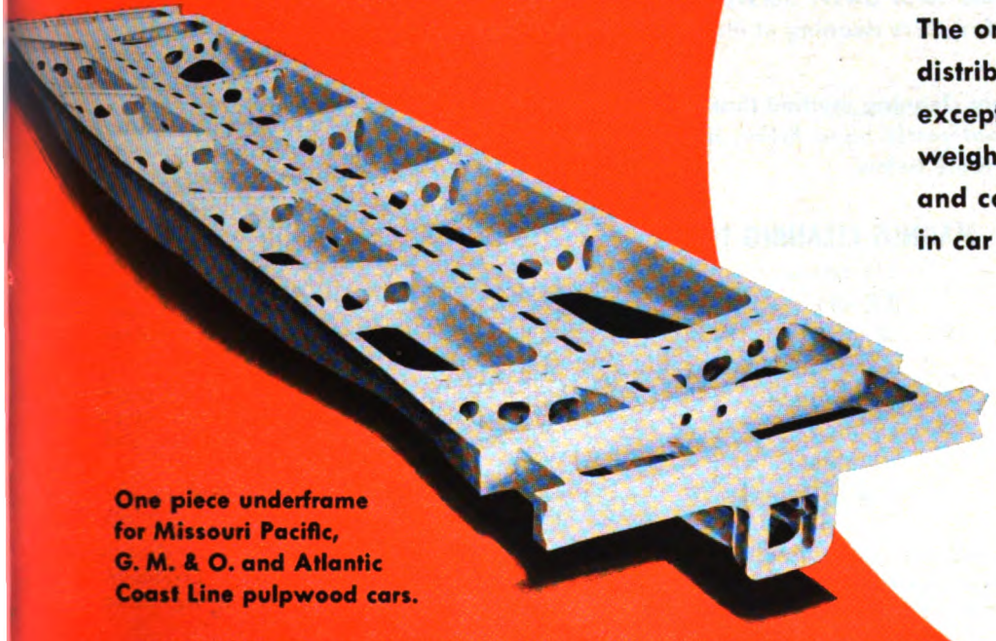
For the Large Freight Car Program

As part of the Defense Preparedness Program, America's railroads placed orders in 1950 for 2000 COMMONWEALTH One-Piece Cast Steel Underframes for flat cars, pulpwood cars and "special service" freight cars.

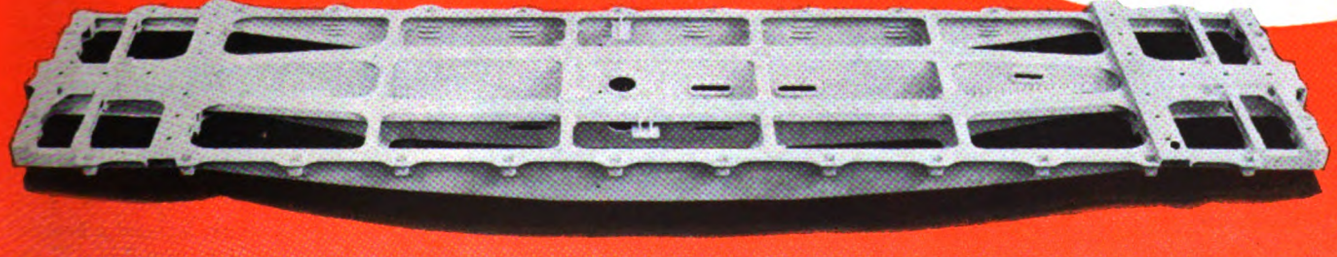
The one-piece construction, with metal distributed where it is needed most, provides exceptional strength without increase in weight, eliminating welded or riveted joints and connections, and saving manpower in car building.

COMMONWEALTH Underframes are practically indestructible. They assure increased availability of freight cars with longer service-life and greatly reduced upkeep costs.

Consult us about your requirements.



One piece underframe for Missouri Pacific, G. M. & O. and Atlantic Coast Line pulpwood cars.

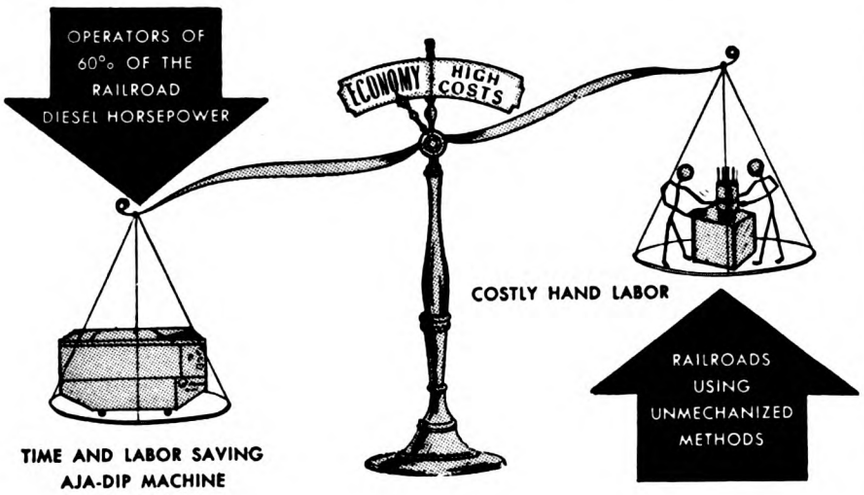


One piece underframe for G. M. & O. and Union Pacific flat cars.

GENERAL STEEL CASTINGS

GRANITE CITY, ILL. — EDDYSTONE, PA.

Operators of 60% of the Diesel Horsepower clean their diesel parts the Magnus way!



DURING the relatively short time since the Magnus Aja-Dip diesel parts cleaning method was introduced to the railroads, roads operating more than 60% of the total diesel horsepower have adopted the Magnus method for fast, sure cleaning of disassembled diesel parts.

WHY? Because there is no other cleaning method that will clean diesel parts mechanically, *without costly hand labor*, in the very short time periods shown in the table below.

DIESEL PARTS	MAGNUS CLEANING TIME
Heads	1½ hours
Liners	2 hours
Rods	20 minutes
Pistons	20 minutes
Blowers	20 minutes
Valves	15 minutes
Strainers	10 minutes
Miscellaneous parts	5 to 15 minutes

Can you afford to be without such time and labor savings in your growing diesel operations? Let us show you how other diesel users are economizing with the Magnus Diesel Parts Cleaning Method. Write for complete information today.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

dian Pacific. For five months he was a locomotive fireman in the employ of the New York, New Haven & Hartford. In February, 1918, he became a yard clerk on the New York, Chicago & St. Louis. After service in the U. S. Army Medical Corps during World War I, Mr. McLeod returned to the Nickel Plate as a special apprentice at Stony Island, Ill., working his way up to general enginehouse foreman in February, 1924. He became mechanical inspector of the Chesapeake & Ohio at Hunting, W. Va., in September, 1933, and subsequently served as assistant master mechanic at Stevens, Ky.; as assistant master mechanic at Peru, Ind., and as master mechanic at Columbus, Ohio. He was appointed superintendent motive power at Richmond on January 1, 1949.

E. R. HAUER, chief mechanical engineer for the Chesapeake & Ohio, the New York, Chicago & St. Louis, and the Erie, has been appointed assistant superintendent motive power, engineering, of the Chesapeake & Ohio, with headquarters at Richmond, Va. The position of chief mechanical engineer has been abolished.

S. A. SCHICKEDANZ, mechanical engineer of the Chicago & Eastern Illinois at Danville, Ill., has retired from service. Mr. Schickedanz was born on April 30, 1884, at Chenoa, Ill., and was educated at Pontiac (Ill.) high school and the University of Illinois receiving his B. S. degree in mechanical engineering in 1911. Before starting his railroad career he was employed as a mechanical draftsman by the United States Fuel Company at Danville. In 1912 he became a mechanical draftsman for the C. & E. I.; in 1915 chief draftsman, and in 1919 mechanical engineer.

Electrical

G. S. GLAIBER, general supervisor electric equipment of the New York Central System, has been appointed assistant superintendent of equipment, with headquarters as before at New York.

H. H. DUEHNE has been appointed general supervisor electric equipment of the New York Central system at New York.

Master Mechanics and Road Foremen

ALBERT BETTON, division master mechanic of the Canadian Pacific at Lethbridge, Alta., has been transferred to Revelstoke, B. C.

WILLIAM STEWART, master mechanic of the Saskatchewan district of the Canadian Pacific, has been appointed master mechanic of the Pacific region, with headquarters at Vancouver, B. C.

C. A. PEASE has been appointed assistant master mechanic on the New York Central, with headquarters at Toledo, Ohio.

W. W. OSRORNE, general foreman, has been appointed master mechanic of the Norfolk division of the Virginian with headquarters as before at Victoria, Va.

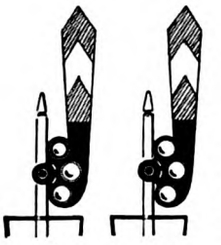
F. G. NOSEWORTHY, locomotive foreman in the Winnipeg, Man., roundhouse of the Canadian Pacific, has been appointed divi-

Question: Just where does "Roller Freight" cut operating costs?



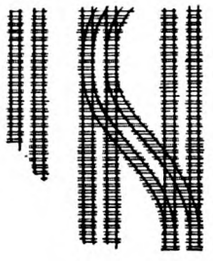
AT TERMINALS

Man-hours needed for terminal inspection are reduced 90% when freight trains are mounted on Timken® tapered roller bearings!



ON THE ROAD

Expenses and delays due to "hot boxes" are practically eliminated by Timken bearings. Roller bearing design minimizes friction, permits better retention of lubricants. And there's no waste to "grab" during humping.



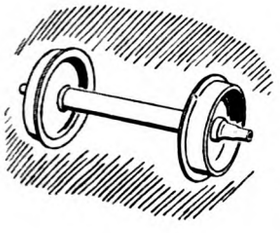
IN THE YARDS

Because "Roller Freight" cars travel faster and spend less time-out for repairs, more cars are available when you need them.



AT DESTINATIONS

Timken bearings cut starting resistance a tremendous 88% to make smoother starts and stops possible. Result: fewer damage claims!



IN THE SHOP

Timken bearings cut repair bills by reducing wear on draft gear and other parts. Impact damage from "serial starting" jolts can be eliminated.



ANYWHERE

You can schedule full-length trains all winter long with "Roller Freight"! Timken bearings reduce friction to a minimum, even in cold weather.

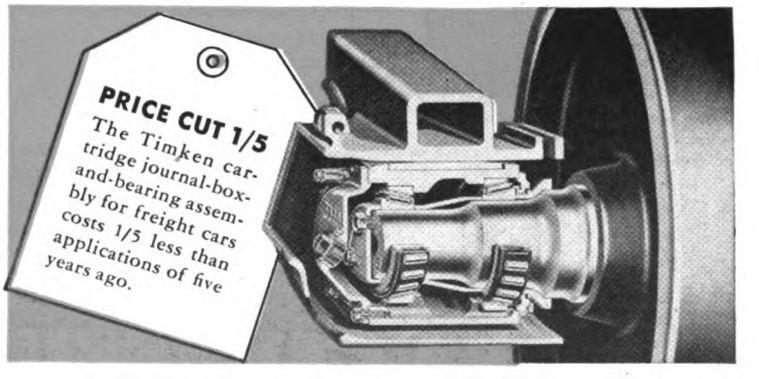
AN EDGE ON COMPETITION, TOO! Besides cutting your operating costs, "Roller Freight" will give you a decided edge on competition in your effort to get a bigger share of tomorrow's freight tonnage. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

Answer: All along the line!

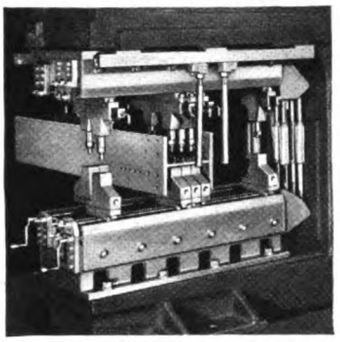
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

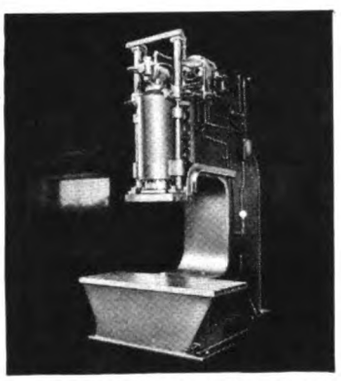
TAPERED ROLLER BEARINGS



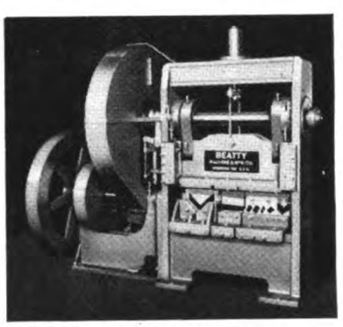
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳



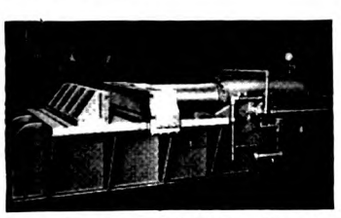
BEATTY Adjustable Tools punch webs of beams and channels, legs of angles and plates.



BEATTY 250-Ton Gap Type Press for forming, bending, flanging, pressing.



BEATTY Guillotine Bar Shear for "short order" shearing without changing tools.



BEATTY Horizontal Hydraulic Bull-dozer for heavy forming, flanging, bending.

WHICH MACHINE MIGHT SOLVE YOUR PROBLEM

BEATTY machines are tailor-made to solve certain production problems — to do a job better, faster, at less cost. And this long and varied experience qualifies our engineers to grasp your problem quickly and to provide a practical, proven solution.

There is a better way to handle most production problems, and our engineers are dedicated to finding that better way. If you have a problem, write us. We have the answer.



HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

sion master mechanic of the Portage division of the C. P. R., with headquarters at Winnipeg, Man.

C. G. FOSTER, master mechanic of the Norfolk division of the Virginian at Victoria, Va., has been transferred to the position of master mechanic at Elmore, W. Va.

J. R. VANNORTWICK, acting terminal master mechanic of the Chicago, Burlington & Quincy, has been appointed terminal master mechanic at Chicago.

R. A. DAVIS has been appointed district master mechanic of the Canadian Pacific, with headquarters at Moose Jaw, Sask.

H. H. NIEMEYER has been appointed master mechanic of the Beardstown division of the Chicago, Burlington & Quincy, with headquarters at Beardstown, Ill.

ARTHUR BAYNHAM, division master mechanic of the Portage division of the Canadian Pacific at Winnipeg, Man., has been transferred to the position of division master mechanic at Lethbridge, Alta.

GEORGE H. NOWELL, master mechanic of the Canadian Pacific's Pacific region, with headquarters at Vancouver, B. C., has retired after 51 years of service with that road.

C. E. PLOTT, master mechanic of the Beardstown division of the Chicago, Burlington & Quincy at Beardstown, Ill., has retired.

FRANK J. SMITH has been appointed general foreman of the Atlantic Coast Line at Waycross, Ga.

WYTHE D. QUARLES, superintendent of terminals at the Atlantic Coast Line at Richmond, Va., has been appointed master mechanic at Waycross, Ga.

Shop and Enginehouse

E. H. WRIGHT has been appointed general foreman at the Englewood enginehouse of the New Yark Central at Chicago.

VAN WILLIAMS, JR., has been appointed general foreman of the Atlantic Coast Line at Montgomey, Ala.

D. J. BOURNE has been appointed general foreman at the Elkhart, Ind., enginehouse of the New York Central.

R. G. BENNETT, JR., master mechanic of the Virginian at Elmore, W. Va., has been appointed shop superintendent at Princeton, W. Va.

W. H. FOSTER, shop superintendent of the Virginia at Elmore, W. Va., has retired.

W. O. BRADLEY, general foreman at the Russell, Ky., car shop of the Chesapeake & Ohio, has been appointed assistant shop superintendent at Russell.

M. P. METZGER has been appointed general foreman of the New York Central at Englewood, Ill.

O. L. EASTON has been appointed general foreman, freight department, of the New York Central at Beech Grove, Ind.

G. R. GIVIDEN has been appointed general foreman, passenger department, of New York Central at Beech Grove, Ind.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oil R.R.

UNIT Diesel Locomotive cylinder assembly

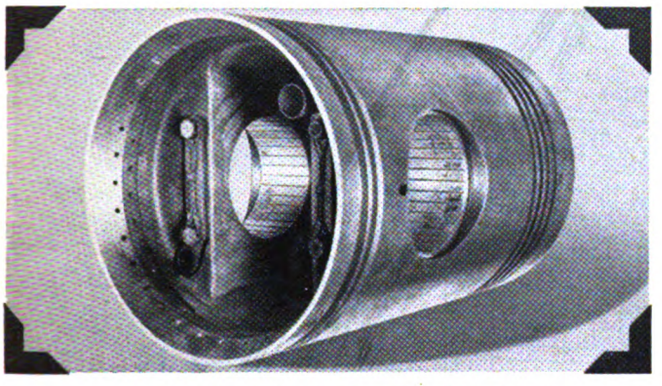
SERVICE Mountain Freight

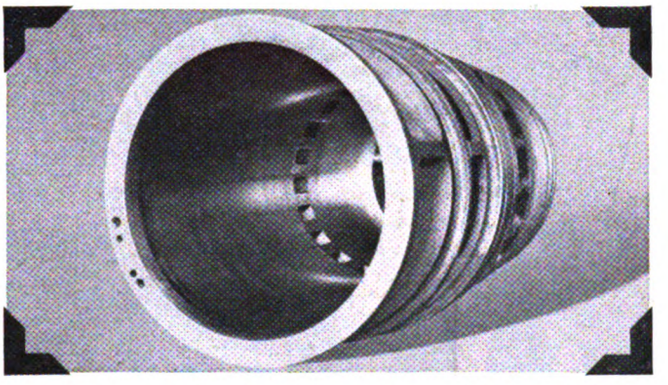
LOCATION Transcontinental freight service on Moffat tunnel + Royal Gorge Routes

PERIOD In excess of 8 years

FIRM Denver & Rio Grande Western R.R.Co.

One million miles of service on cylinder liners and pistons





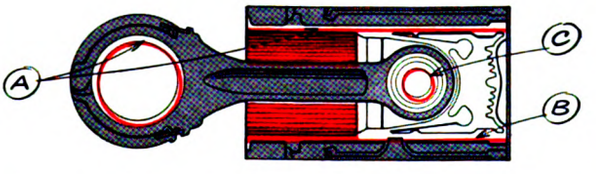
IN SERVICE APPROXIMATELY 1,000,000 MILES in Denver & Rio Grande Western Railroad diesel locomotive engines, this piston and cylinder liner were always lubricated with RPM DELO Oil R.R. At the end of that time wear measurements (inches) were only: Piston Skirt—0.001; Ring Grooves—No. 1—0.003 to 0.006, No. 2—0.002, No. 3 & 4—none; Cylinder liner (maximum diameter)—0.0095, (out of round)—0.002 to 0.004.



RPM DELO Oil R.R. has been the standard on the Denver & Rio Grande Western Railroad for over-the-road freight and passenger locomotives since their first power of this type was placed in service in January 1942. At the time this inspection was made approximately 49,563,104 miles had been traversed by the Rio Grande freight diesel fleet of 100 units and during that period only 77 cylinder liners had been scrapped for any reason. At that time many of the original pistons and cylinder liners were still in service and the average age of all these assemblies, including recently purchased power, was 4.7 years.

TRADEMARK "RPM" REG. U.S. PAT. OFF.

How RPM DELO Oil R. R. prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean... helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushings or bearing metals and foaming in crankcase.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N.J., Chicago, New Orleans
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado

STOP RUST



Available in many colors, aluminum and white.

RUST-OLEUM can help you control rust—to cut your maintenance costs—and to avoid needless rust losses. It stops rust effectively—and prolongs the useful life of rustable metal so that costly replacements can be deferred years longer than previously could be expected.

Railroads find RUST-OLEUM the practical answer to many rust problems. Its tough, pliable film gives excellent protection to rolling stock, bridges, tanks, metal buildings, signal equipment and other properties.

CUT YOUR MAINTENANCE COST

Rescue metal that has already started to rust. RUST-OLEUM can be applied *even* over metal already rusted —usually without sandblasting or the use of chemical cleaners. Simply scrape and wire-brush to remove rust scale and loose rust. Then apply RUST-OLEUM by brush, dip, or spray. It stops the rust, and promptly dries to a firm, pliable, rust resistant protective coating.



Write for your copy of the RUST-OLEUM Railroad Catalog



RUST-OLEUM CORPORATION

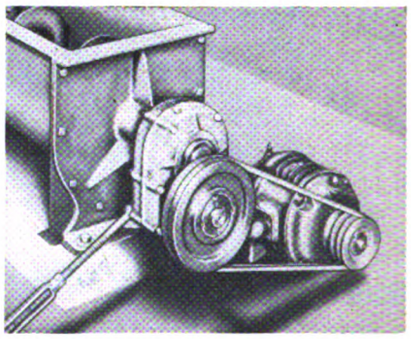
2590 Oakton Street **EVANSTON, ILLINOIS**

(*Continued from page 87*)

not cause errors in the measurement of applied voltage and does not damage the tester.

The tester is enclosed in a metal cabinet with a convenient carrying handle. It operates from a power supply of 105 to 125 volts a.c. of 60 cycles. It is available in either single or dual range models. The single range model has an output of 0 to 3,200 volts, r.m.s. The dual range model has an 0 to 1,600-volt range in addition to the 0 to 3,200. For odd frequencies and higher voltages, special models can be made.

The primary circuit uses resistance and a potentiometer to supply an adjustable voltage to the primary of the transformer and to damp out line surges. Because of its current limiting feature, the instrument is approved for use without the usual interlocks, cages and safety barriers.



Shaft-Mounted Torque-Arm Reducer

Claimed to be the first shaft-mounted reduced designed for output speeds from 115 to 330 r.p.m., the illustrated single reduction unit is being produced by the Dodge Mfg. Company, Mishawaka, Ind., in four sizes to cover capacities up to 27 hp.

Ease and economy of installation of the unit are attributed to shaft mounting which eliminates engineering, cost of a foundation, flexible couplings, sliding base, and time consuming operation of lining up.

The device is locked securely to the driven shaft by means of two steel locking collars—one on each side of the reducer. It is anchored to the floor or any other fixed object by the torque-arm. While it can be driven through any V-belt drive, the designers recommend their Taper-Lock sheaves for facility either of installation or removal and for maximum efficiency of operation. Flat-belt drive can also be used.

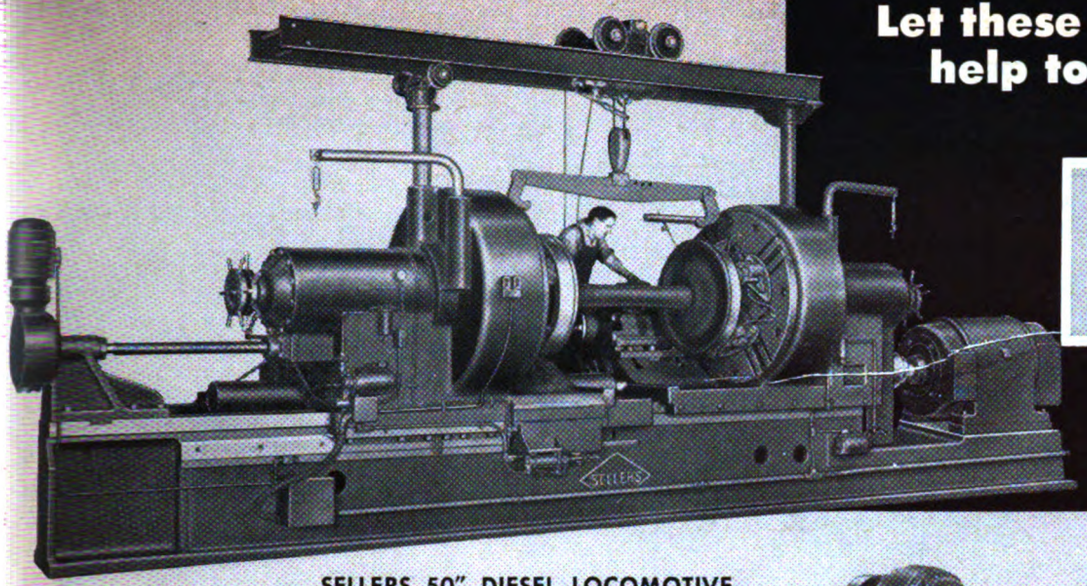
Any required output speed within the recommended range of 115 to 330 r.p.m. can be obtained with stock sheaves properly related in size. Variations of that speed are accomplished simply by changing sheave sizes.

Construction features include a machined cast iron housing, deep groove ball bearings, and helical steel gears which are shaved for quiet operation and heat treated. The unit is comparatively light in weight, the No. 12 size weighs but 49 lb.

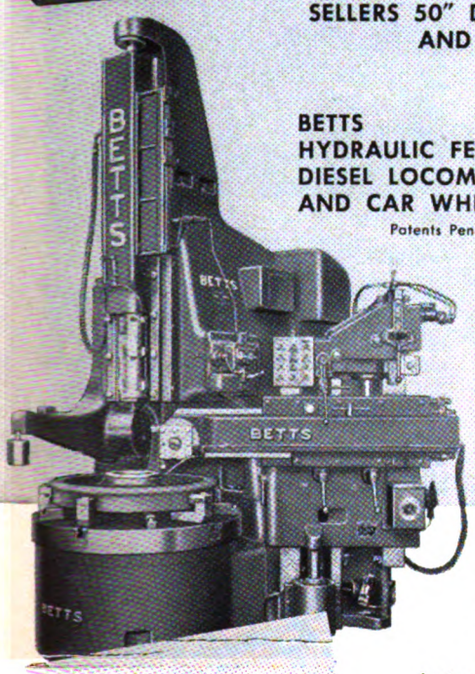
Also provided is a backstop. Wherever required to prevent reversal of direction of

Let these modern machines help to reduce your costs

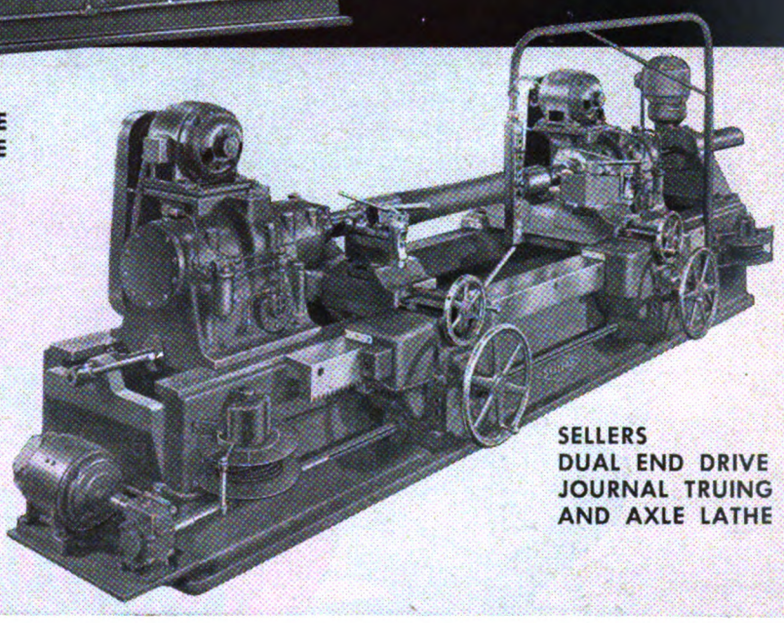
Faster, more economical production for all your diesel locomotive and car wheel and axle work



SELLERS 50" DIESEL LOCOMOTIVE AND CAR WHEEL LATHE



BETTS
HYDRAULIC FEED
DIESEL LOCOMOTIVE
AND CAR WHEEL BORER
Patents Pending



SELLERS
DUAL END DRIVE
JOURNAL TRUING
AND AXLE LATHE

Among Railroad Tools built by Consolidated are . . .

- CAR WHEEL BORERS
- DIESEL WHEEL BORERS
- BURNISHING LATHES
- TIRE MILLS
- END DRIVE AXLE LATHES
- CENTER DRIVE AXLE LATHES
- JOURNAL TRUING LATHES
- DRIVING WHEEL LATHES
- CAR WHEEL LATHES
- RADIUS LINK GRINDERS
- PROFILE MILLING MACHINES
- SLAB MILLING MACHINES
- ROD MILLING MACHINES
- CYLINDER BORING MACHINES
- KEYWAY MILLING MACHINES
- CRANK PLANERS
- DRILL PRESSES
- AND OTHERS

SELLERS 50" DIESEL LOCOMOTIVE AND CAR WHEEL LATHE turns diesel locomotive and car wheels from 28" to 50" tread diameter. Designed with speed range suitable for either carbide or high speed steel tools. Two mechanical speed changes in conjunction with a variable speed 75 H.P. motor provide speed ranges of approximately .9 to 3.6 R.P.M. and 5 to 20 R.P.M. of faceplate with instantaneous speed selection. Faceplates are recessed, with removable filler blocks, for turning diesel wheels, motor coach wheels and trailer wheels with roller bearings. As illustrated, this machine is arranged with four self-equalizing hydraulic drivers on each faceplate, insuring equalized pressure on the wheel rims.

BETTS HYDRAULIC FEED DIESEL LOCOMOTIVE AND CAR WHEEL BORER takes diesel locomotive wheels up to 48" tread diameter, passenger and freight car wheels down to 30" tread diameter. Hydraulically operated side head, for turning and facing hubs, has feed and rapid traverse vertically and horizontally with supplementary hand feed. Full automatic boring cycle from loaded start to stop supplemented by manual operation at any point in the automatic cycle. Speed range suitable for either carbide or high speed steel tools.

SELLERS DUAL END DRIVE JOURNAL TRUING AND AXLE LATHE for both new and reconditioning work, this machine turns and burnishes rough turned AAR car axles in sizes from 4¼" x 8" up to and including 6½" x 12", and turns and burnishes journals and collars on mounted car wheel sets up to and including 38" tread diameter. It is also available with greater swing for larger wheels. Designed with speed range suitable for carbide tools.

Full details covering any or all of these modern Consolidated machines will be furnished upon request. Let us show you how their labor-saving features not only can help to reduce your costs but also, by largely eliminating manual operations, encourage the operator to make full use of the higher production capacities of which these machines are capable.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

HESTE



As specialists for over 40 years in brushes for all types of electrical rotating equipment, Stackpole has played a big part in developing better carbon brush grades for modern Diesel motors, generators and auxiliary equipment. Each Stackpole brush recommendation is based on actual "on the job" tests that assure top notch performance, minimum commutator maintenance and maximum brush life for your specific operating conditions.

Stackpole Diesel Brushes are sold only to makers of original Diesel equipment. Replacement brushes can be purchased through these manufacturers.

STACKPOLE CARBON CO.
ST. MARYS, PA.

RAIL BONDING MOLDS • CARBON RHEOSTAT DISCS • PUMP AND FLUID DRIVE SEALS • WELDING CARBONS • BRAZING TIPS • ELECTRONIC COMPONENTS • CONTACTS and dozens of other items.

load, it is easily installed on the input shaft within the reducer where it is sealed against dust and dirt.



Guarded Light

A lighting fixture which is protected against breakage and combines lighting efficiency with beauty has been made available by Strickley & Company, Los Angeles 5, Calif.

The light is designed for use in industrial plants and shops, and all places in which breakage creates a hazard. Simplicity of installing, relamping, cleaning and choice of finishes are features.

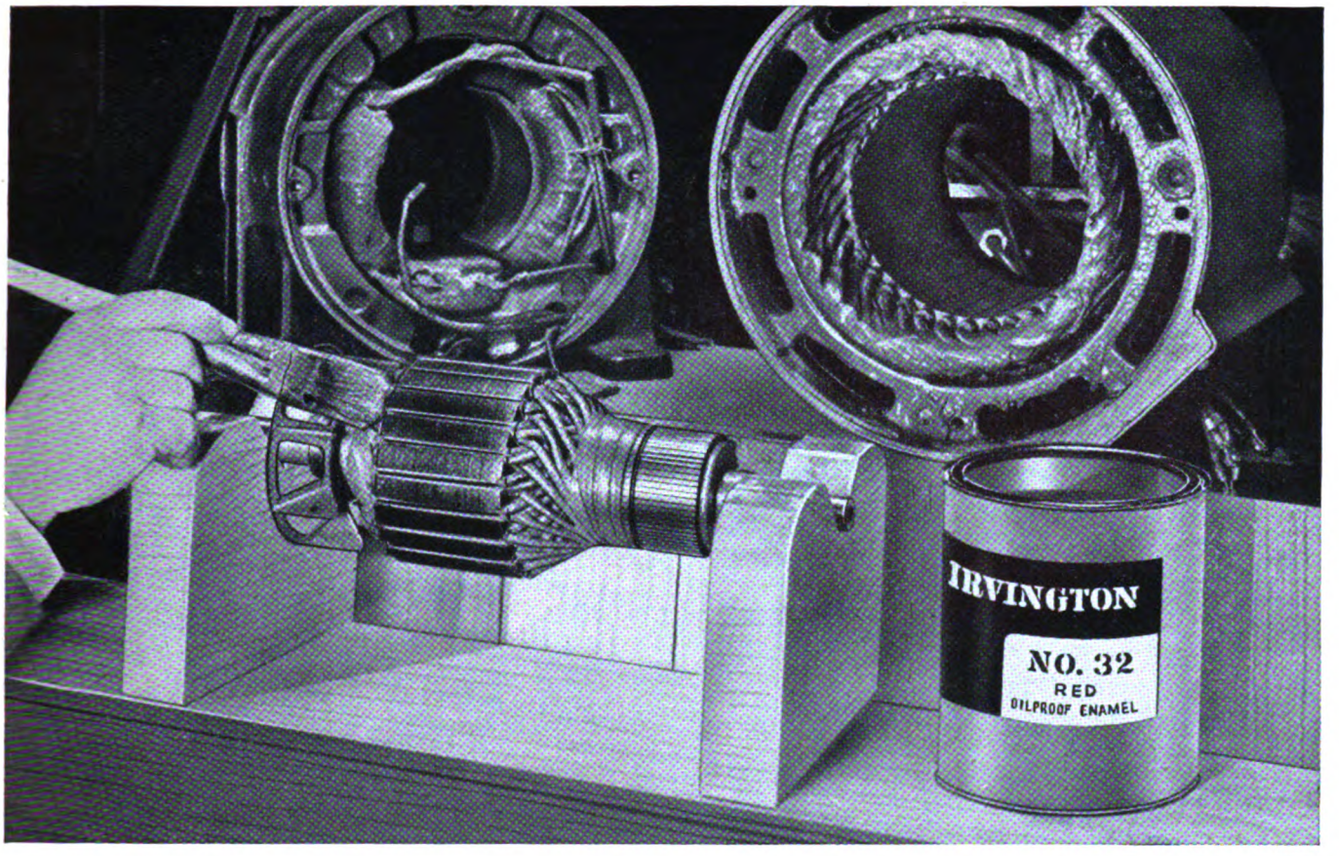
Standard opal glass is protected with cork gaskets and steel grill. All metal is non-ferrous except front and end grills which are rust-proofed. Open ends prevent accumulation of bugs and dirt. The 150-watt lamp is replaced by backing off one non-loseable screw. The unit is supplied in architectural bronze or brushed cadmium or old iron. The height is 13 in., the width 9 in. and the depth 5 in. Shipping weight is 6 lb.

General Purpose Driving Tool

Named the Impakdriver, a new general purpose tool is now avaiable from the H. K. Porter, Inc., Somerville, Mass. The device is useful in repair, maintenance, installation and production work where screws, bolts or nuts must be turned.

With a twist in the desired direction and a few raps with a hammer, screws, bolts or nuts can be tightened or loosened easily and quickly. This alloy steel hand tool is constructed on a cam principle that translates the impact from a hammer's blow into an amount of torque.

Particularly useful for starting stubborn nuts, bolts or screws that are rusted or frozen on, the tool also provides an answer for working in hard-to-get-at places. For mechanics, machinists, repair men, maintenance men, the Impakdriver solves many



Here's the LOW-COST way to HIGH oil resistance

When insulation must have outstanding resistance to oil and grease, do the job the fast, inexpensive way—with Irvington No. 32 Red Enamel.

Irvington No. 32 Red costs less to *buy*—costs less to *use*. Just brush it on as the finish coat, over *any* type of insulation treatment. It is dry enough to handle in half an hour—completely dry in 8 hours.

With its dielectric strength of 800 volts per mil, the tough, adherent film gives a big plus in electrical protection—*along* with its resistance to oil, water, chemicals and abrasion.

Buy enough No. 32 Red at a time to be sure it's always on hand—you can store it without deterioration for long periods of time.

Send coupon today for free sample and technical data.

Look to
IRVINGTON
for insulation leadership
INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

IRVINGTON INSULATION

Send this convenient coupon now

Irvington
VARNISH & INSULATOR COMPANY
Irvington 11, New Jersey

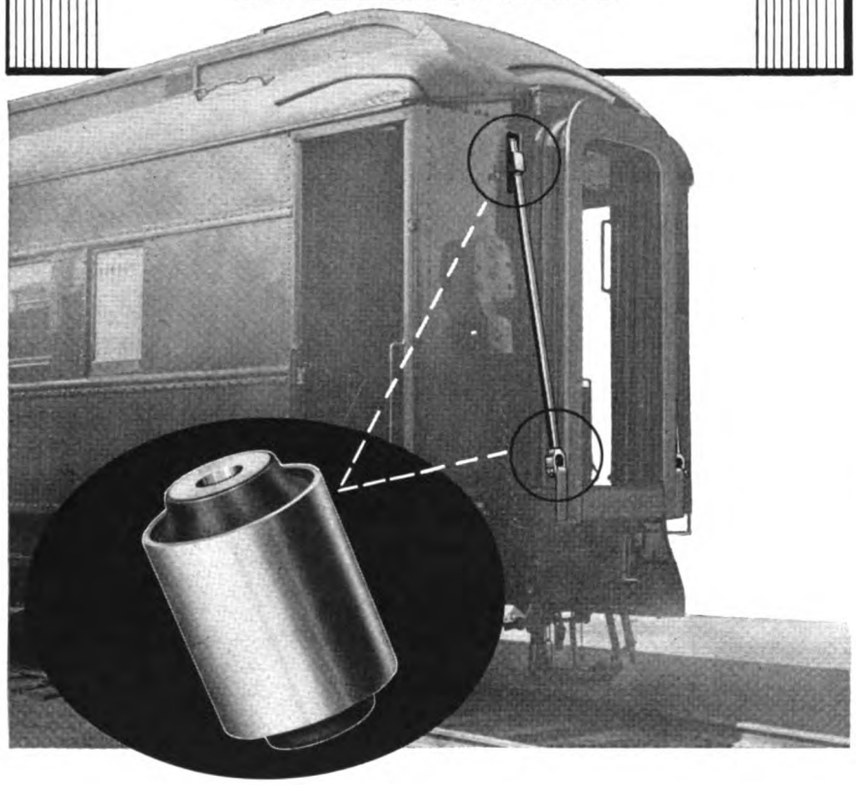
RM 2/51

Irvington Varnish & Insulator Company
6 Argyle Terrace, Irvington 11, N. J.

☐ Please send me technical data on your No. 32 Red Enamel.
☐ I'd like a free sample for testing.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

QUIET
VESTIBULE DIAPHRAGMS
. . . one of many applications of
LORD MOUNTINGS
IN RAILROADING



Canadian Pacific Railway was recently confronted with the problem of designing vestibule diaphragm supports which would accommodate movement of the diaphragm, require no maintenance, and remain permanently quiet. The answer proved to be both simple and inexpensive. Standard LORD Bonded-Rubber Mountings were designed into both ends of the supports.

Although best known for their ability to isolate vibration, LORD Mountings are also used by many industrial designers wherever it is necessary to provide for relative movement between parts. They prevent transmission of sound . . . support loads of a few ounces or hundreds of pounds . . . act as torsion springs . . . and allow predetermined amounts of torsional, longitudinal, lateral, and angular movement.

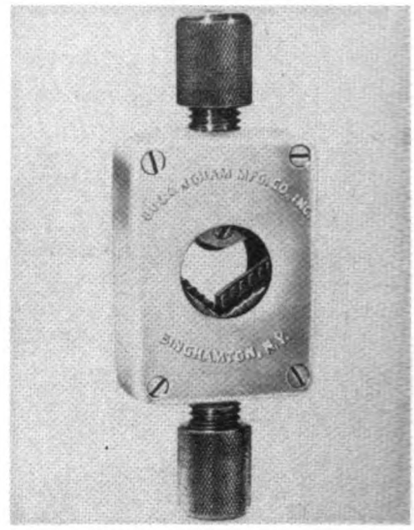
LORD Bonded-Rubber Mountings save space, simplify design, and eliminate expensive assemblies. When you have a design problem which involves relative movement of parts, it will pay you to consult with LORD engineers. Write to attention of Product and Sales Engineering Department.

LORD MANUFACTURING COMPANY · ERIE, PA.
Canadian Representative: Railway & Power Engineering Corp., Ltd.

LORD BONDED RUBBER — *Vibration-Control Mountings . . . Bonded-Rubber Parts*

problems and saves tremendous amounts of time.

It is sold by itself or in sets with different combinations of bits and sockets for various sizes and types of screws, bolts and nuts.



Close Quarter Thread Restorer

The illustrated unit is suited for reconditioning closely spaced studs and bolts that are battered, distorted or rusted. Produced by Buckingham Manufacturing Company, Binghamton, N.Y., this product is added to a line of four other types of thread restorers to take care of all ASME and SAE standard threads from ¼- up to 4-in. diameter.

With a swing of only 2-5/16 in., this device works readily in close quarters, particularly on cylinder heads of automotive, marine diesel and steam engines, also on wheel lugs, spring hangers, actual shafts and pipe.

Its adjustable cutting jaws can be fitted by a simple twist of the handle to any male thread of ¼- to 1-in. root diameter, either right- or left-hand. The jaws may be engaged at the bottom of the threaded section, and turned out toward the top, leaving clean end threads in which nuts may be started and run down easily.

No die sets are required for interchange of size or type of thread. The tool is completely self contained and weighs only 1¼ lb.

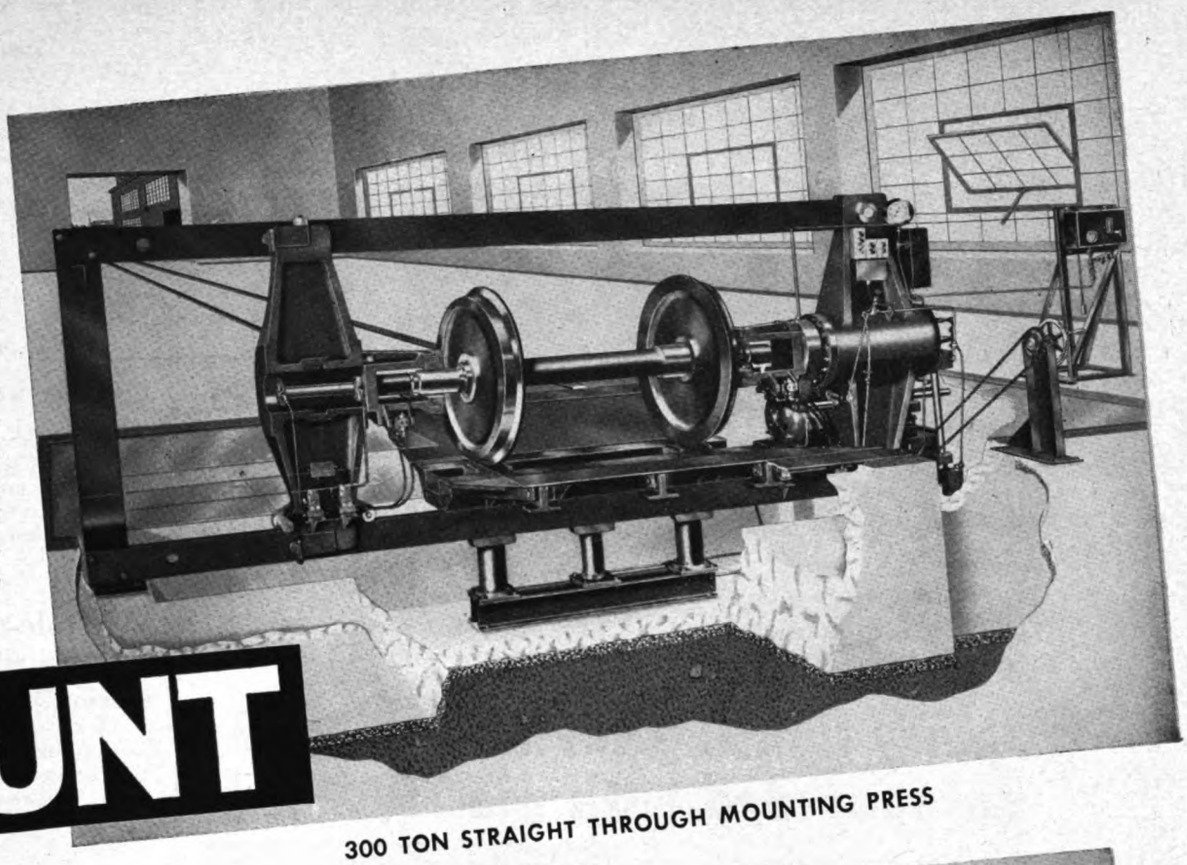
One Quart Fire Extinguisher

The American LaFrance-Foamite Corporation, Elmira, N. Y., has designed and placed on the market a one-quart air-pressurized fire extinguisher. This unit discharges a vaporizing liquid fluid for extinguishing both flammable liquid and electrical type fires.

The device is aimed and operated like a gun with trigger-quick action. It hits

Now, ALL Railroads can put wheel mounting and demounting operations on a real production basis with new, modern W-S Wheel Mounting and Demounting Presses.

Incorporating outstanding design and construction features, these latest developments of W-S Engineers provide the fastest cycle of operation ever attained in this type of equipment, and they handle any type of wheels.



300 TON STRAIGHT THROUGH MOUNTING PRESS

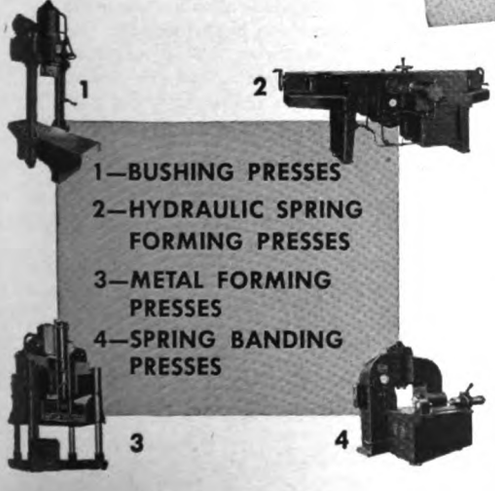
MOUNT and DEMOUNT in Seconds with NEW W-S WHEEL PRESSES

Smashing time records daily, these New Watson-Stillman Speed Presses permit YOU to set your own floor-to-floor speed time—and this is only limited by your loading and unloading facilities.

Get the story today from one of the W-S Representatives listed below.



600 TON STRAIGHT THROUGH DEMOUNTING PRESS



1—BUSHING PRESSES
2—HYDRAULIC SPRING FORMING PRESSES
3—METAL FORMING PRESSES
4—SPRING BANDING PRESSES

WATSON-STILLMAN

HYDRAULIC MACHINERY DIVISION ESTABLISHED 1848

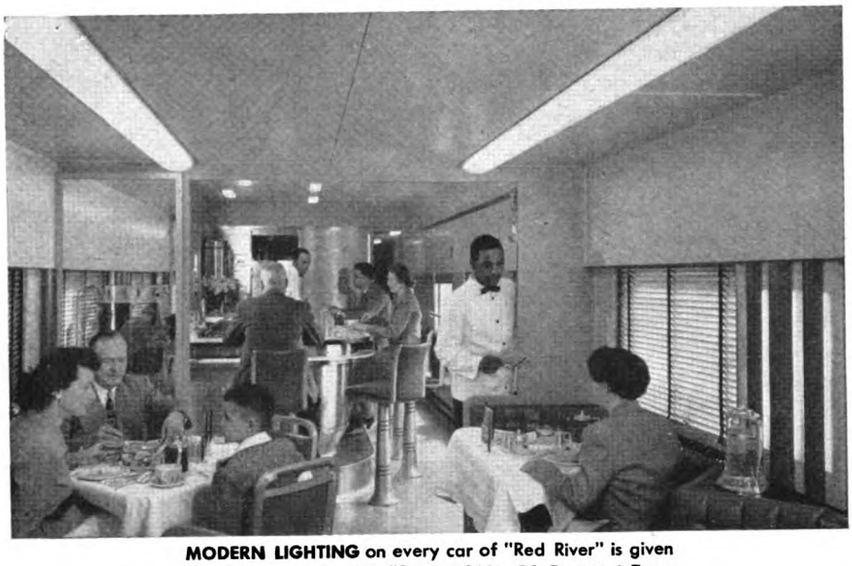
Factory and Main Office: ROSELLE, NEW JERSEY • Branch Office: CHICAGO, ILL.

Manufactured in Canada by CANADIAN VICKERS, Ltd., MONTREAL

REPRESENTATIVES

Chicago 4, Ill. ..... W. R. Walsh	St. Paul 4, Minn. ..... Anderson Machine Tool Co.
Denver 2, Colo. ..... Overgard Machine Tool Co.	San Francisco 5, Calif. ..... Overland Supply Co.
New York 17, N. Y. ..... Eastern Railway Supplies, Inc.	Washington 5, D. C. ..... Ralph Payne

9-1-12



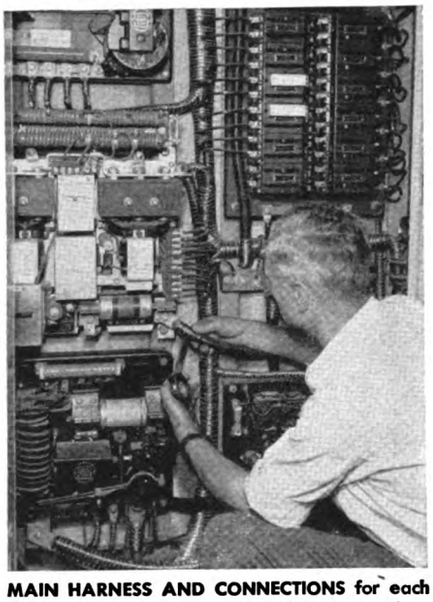
MODERN LIGHTING on every car of "Red River" is given perfect protection with "SCOTCH" No. 33 Electrical Tape

Luxury lighting for luxury trains safeguarded with plastic tape!

Great Northern's newest train, the "Red River", is modern and streamlined in every way! Even the lighting circuits are given compact, streamlined wiring with "SCOTCH" No. 33 Electrical Tape — the tape that makes safe splices in small places.

This new plastic tape gives perfect insulation for many railway wiring jobs. Thin caliper—only .007 inch—seals smoothly around all surfaces. High dielectric strength — 10,000 volts — gives safe, neat protection.

You'll find "SCOTCH" No. 33 Electrical Tape easy to apply — does the work of two conventional tapes; goes on in *one* quick operation. Try this new time-saver on your next job. Write Dept. RE-251 for further Details.



MAIN HARNESS AND CONNECTIONS for each car's switchboard and regulator locker are given a neat wrap with "SCOTCH" No. 33 Electrical Tape. Plastic tape resists abrasion, is unaffected by water, oil, alkalies, and most acids.



The term "Scotch" and the plaid design are registered trade-marks for the more than 100 adhesive tapes made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn. — also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Durex Abrasives Corp., New Rochelle, N. Y. In Canada: Canadian Durex Abrasives Ltd., Brantford, Ontario.

the fire target accurately with no unnecessary loss of liquid. No pumping is required. Simply aim and squeeze the trigger with one hand.

This device is called the Alfco pressurized fire-gun and carries the inspection and approval label of Underwriters Laboratories. It is recharged by simply pouring in more vaporizing liquid and can be pressurized with any standard air chuck as commonly used in gasoline service stations, or it can be pressurized with any ordinary tire pump.

The unit is said to be ideal for protecting automobiles, motors, trucks, trailers, street and railroad cars and electrical equipment. It will stop small oil and grease fires from becoming big blazes.

Multiple-Alloy Plate Steel

The first of a new group of alloy steels to be known as T-steels is Carilloy T1, a multiple-alloy plate steel, which combines high strength with ductility and toughness, even at sub-zero temperatures, is available from the United States Steel Corporation's subsidiary, the Carnegie-Illinois Steel Corp., New York, N. Y.

With almost double the strength of high-strength, low-alloy steels and almost triple that of ordinary welding grade structural steels, the product promises to effect considerable savings in applications calling for heavy steel members of ½ in. thickness and up. It is designed to be at least two to three times as resistant to atmospheric corrosion as plain carbon steels.

This plate steel is furnished heat treated to a minimum yield strength of 100,000 lb. per sq. in. pressure. It maintains adequate toughness at this level of strength and is said to be suitable for application where high strength and good weldability are required.

Welding does not affect its properties adversely. If low-hydrogen type electrodes are used, Carilloy T1 is not susceptible to underbead cracking. Electrodes that will develop the full strength of the T1 basic metal are available.

No special equipment and procedures are required for fabrication. Bending or forming may be accomplished cold if sufficient power is available to overcome the high yield strength. If hot forming is necessary, the operation must be followed by heat treatment which involves liquid quenching and tempering after the hot forming operation.

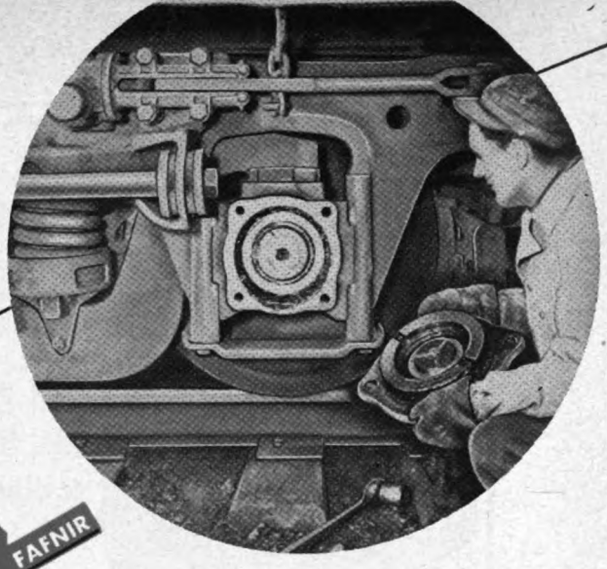
The properties of this steel are obtained by blending multiple alloying elements, coupled with precision heat treatment. Carbon content is restricted to 0.18 maximum to promote ease of welding and gas cutting.

Antiseptic Dust Control

A time-saving, dust-control method of floor care through use of Antiseptic Westone has been announced by the West Disinfecting Company, Long Island City 1, N. Y.

It is claimed that the utilization of this









TIMKEN FAFNIR S.K.F. HYATT

LUBRIKO GREASE

M-1 SPECIAL
FOR ROLLER BEARING CAR JOURNALS

YOUR Roller Bearing Car Journals Should Be GREASE LUBRICATED

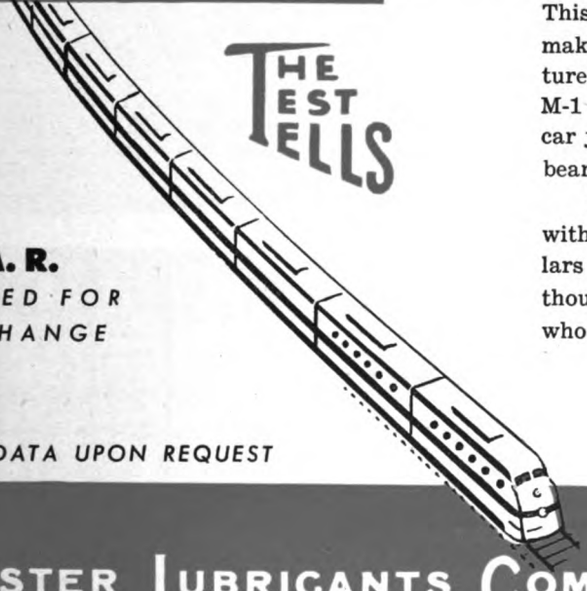
...here's ALL FOUR famous makes of bearings—LUBRIKO LUBRICATED!

This group of pictures marks a milestone in progress. All four famous makes of bearings are shown with Lubriko Grease lubrication. The pictures were made from trains in actual daily use...not on tests. LUBRIKO M-1 SPECIAL GREASE FOR RAILROADS is past the test stage for car journals—it is now proved and approved for grease lubricated roller bearing car journals of all makes.

The change over from oil to grease can, in most instances, be made without mechanical changes in equipment. The change in terms of dollars saved and efficiency gained means many thousands of dollars to the well-known railroads who are now taking this step.*

THE TEST TELLS

A. A. R.
APPROVED FOR INTERCHANGE



*ENGINEERING DATA UPON REQUEST

You are SAFE with LUBRIKO
THE MASTER LUBRICANT

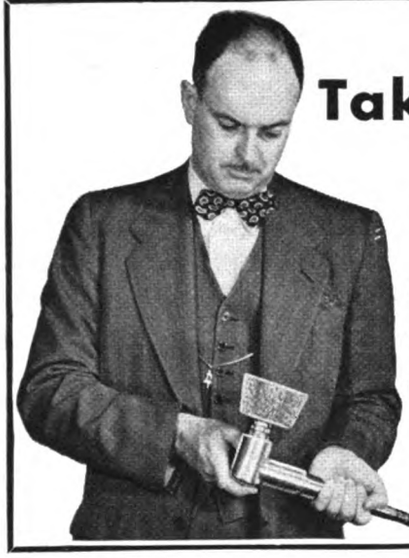
MASTER LUBRICANTS COMPANY

PHILADELPHIA, PA.

MANUFACTURERS OF HIGH-GRADE INDUSTRIAL LUBRICANTS FOR OVER 50 YEARS

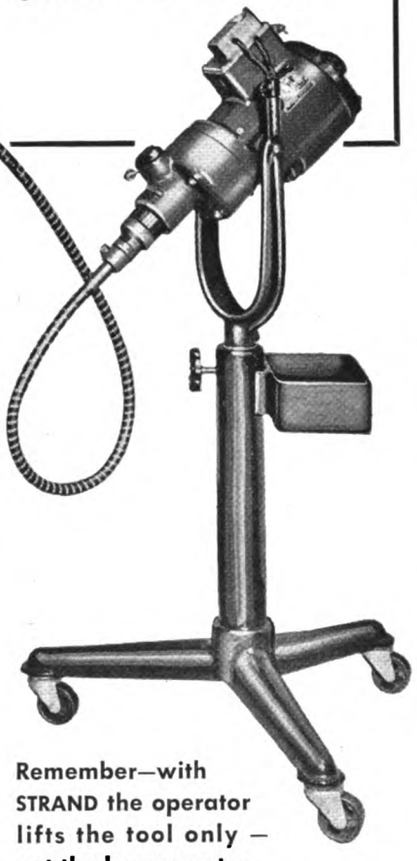
LOS ANGELES • BOSTON • SAN FRANCISCO

Incorporated 1908 — Established 1891



Take a look at *Strand*

and you'll see why it's the finest flexible-shaft equipment made today



This particular machine is the new 4-speed Strandflex. No belts are used—a patented gear-drive assembly mounted on the motor permits quick, easy, positive speed change. Entire motor-drive unit, including even the starting switch, is completely enclosed to seal out dirt, dust and grit—and give you many *extra* years of trouble-free service.

The STRAND line of flexible-shaft tools — manufactured by the N. A. Strand Company, a wholly-owned Franklin subsidiary—includes, also, belt machines up to 3 hp. It provides a selection of portable, easily controlled, light-working-weight tools which can be used in tight places, on the bench or floor, for — *grinding — polishing — buffing — wire brushing — rotary filing — sanding — nut setting — screw driving.*

Each of our offices has STRAND equipment available for demonstration at any time you suggest. If this is not practical, won't you write for one or more of the following:

Remember—with STRAND the operator lifts the tool only — not the heavy motor.

Catalogue #31—Single-speed and three-speed countershaft types—⅓ to 3 hp
Bulletin #43 — Four-speed "Strandflex" gear type — ¼ to ½ hp
Bulletin #47 — Rotary files and cutters
Bulletin #48 — Wire brushes
Bulletin #49 — Abrasive and grinding attachments
Bulletin #50 — Buffing and rubbing attachments

REG. U.S. PAT. OFF.

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER POWER REVERSE GEARS • FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS JOURNAL BOXES • FLEXIBLE JOINTS • TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT



product has resulted in: reduction of dust damage to machinery, instruments, to materials and products during manufacturing operations and storage; less absenteeism, because it provides a cleaner atmosphere; a substantial reduction in maintenance costs; generally increased sanitary conditions.

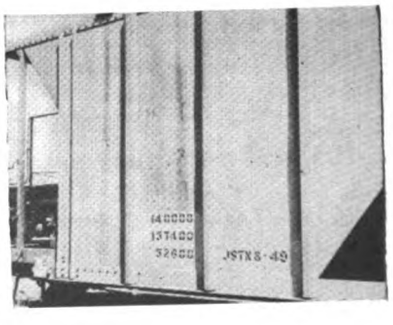
The compound keeps the air free from dust because it is formulated for the preservation of floor surfaces, enhancement of floor beauty, and elimination of dust. This helps prevent the spread of the harmful bacteria and viruses. It removes dust from floors, leaves an antiseptic film which inhibits the growth and multiplication of bacteria. Its surface-sealing film holds down subsequent dust for quick and easy removal.

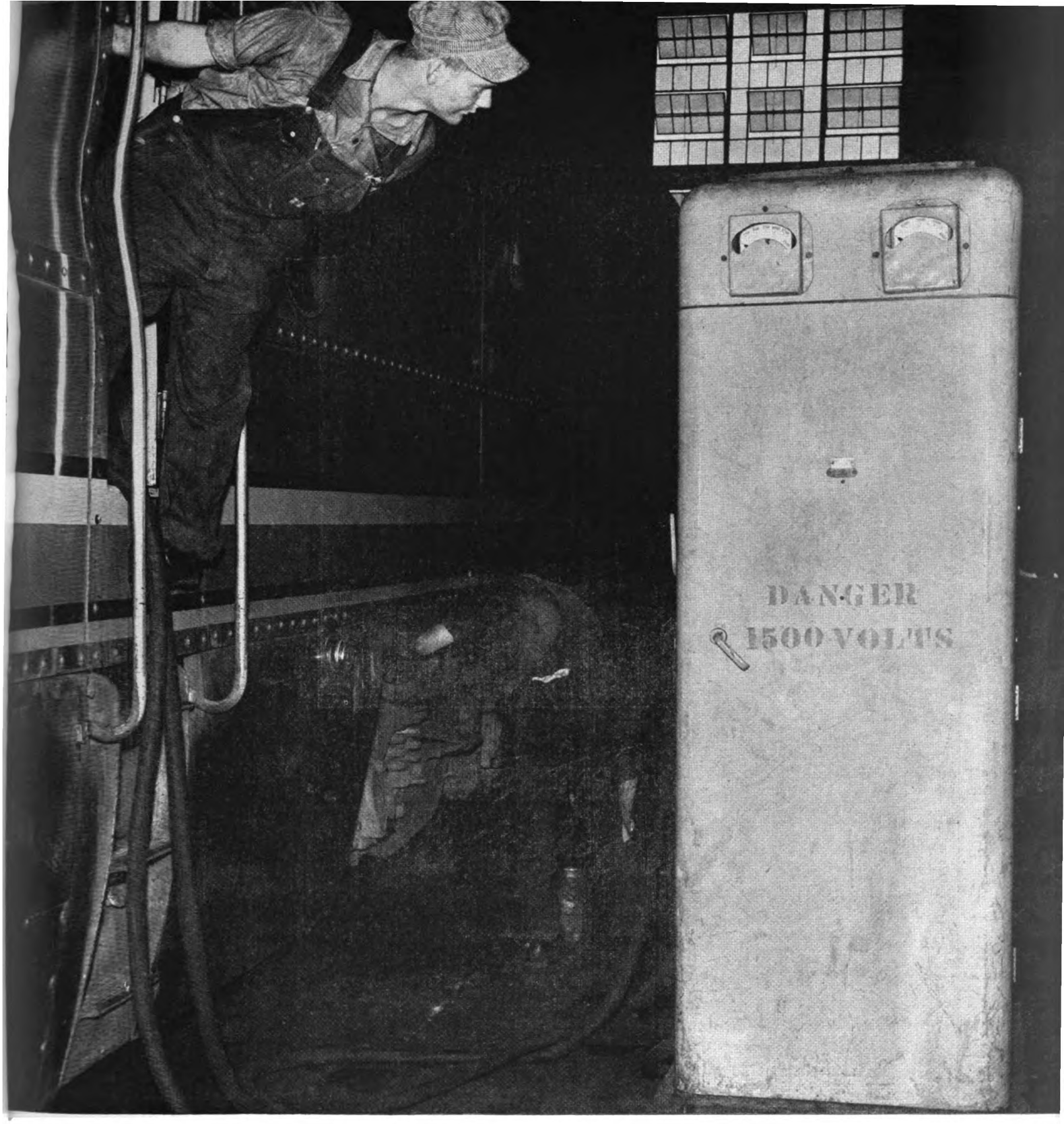
Antiseptic Westone is easy to apply. One gallon covers 4,000 sq. ft. of floor surface. It is stainless and clean to use with a rag, mop or by spraying. Floor maintenance cost reductions up to 50 per cent have been realized.

Alkali-Resistant Vinylite Resin

Corrosive action of acids, alkalis and other chemicals on railroad hopper cars and similar equipment is forestalled up to six times by a new finish produced by the Sherwin-Williams Company, Cleveland, Ohio, in conjunction with the Bakelite Division, Union Carbide and Carbon Corp., New York 17.

Test cars, as shown in the top illustration, painted with this vinylite resin finish carried cargoes such as cement and soda ash more than three years. They remained almost completely free of corrosion—even





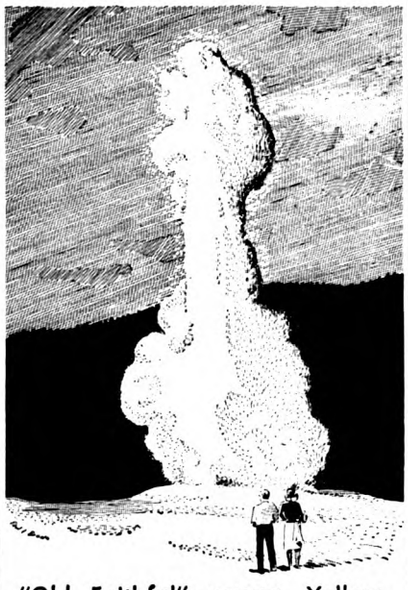
G-E PORTABLE LOADING RESISTOR SIMPLIFIES TESTING

Complete checking, of diesel-electric performance—without moving the locomotive—can be done with the G-E *portable* loading resistor. Tests diesel-engine output, and generator and control performance—quickly, accurately, simply. One man can often do the whole job, and there is no complicated operating or maintenance procedure. Write for further details. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Shop Motors and Controls • Shop Testing Equipment • Undercar Power Plants • Lighting Systems • Electric Heaters • Signal Power Systems • Power Distribution Systems • Electric and Diesel-Electric Locomotives

GENERAL ELECTRIC

THERE'S ONLY ONE



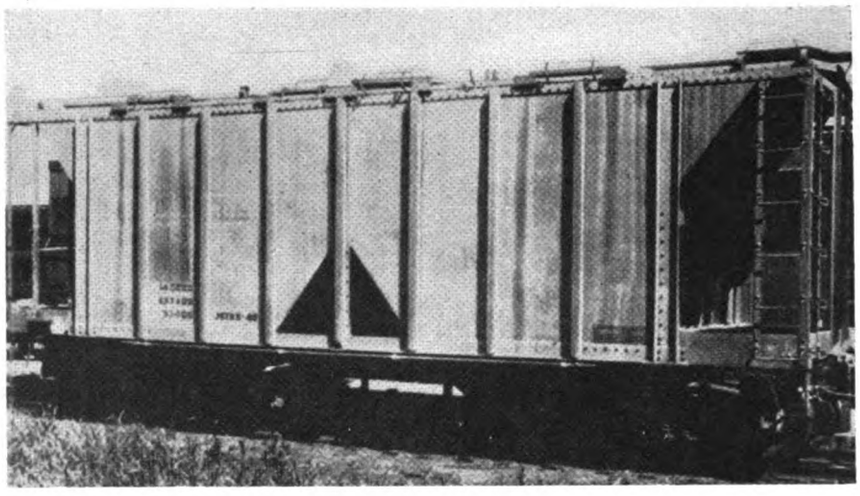
"Old Faithful" geyser, Yellowstone National Park's greatest attraction, has erupted more than half a million times since General Washburn named it in 1870.

You can depend on "Old Faithful's" hourly eruptions which last four minutes and attain a height of from 116 to 171 feet.

THERE'S ONLY ONE windshield wiper that has proven its dependability by being used on over 90 percent of today's modern diesel locomotives. Throughout the years SPRAGUE Air-Push Windshield wiping equipment has been using air power to keep windshields clear of rain, sleet and snow.

Sprague
DEVICES, INC.
Michigan City, Indiana

MANUFACTURER OF THE FAMOUS
AIR-PUSH WINDSHIELD WIPER



where sledge hammers had been used to break cargo loose as shown below.

In addition to providing long-life resistance to corrosive effects of acids, soda ash, sulphur, alkalis, phosphate, common salt, and cement, the finish withstands repeated scrubbing and washing with strong cleaning compounds. It has the weather durability of the best grade synthetic enamels as well as unusual abrasion resistance.

Concentrated acids affect the finish to some extent, but not so readily as they affect comparatively short-lived conventional finishes. Aromatic hydrocarbons, ketones, esters and some chlorinated hydrocarbons will soften the finish but as long as no abrasion occurs, the film will harden to its original state when allowed to dry.

The finish is recommended for use on covered hopper cars, tank cars, tank container cars, refrigerator cars and some other equipment subjected to similar rigorous service conditions. It is applied with the same equipment and technique normally used to apply a synthetic lacquer or enamel.



HERE'S Half a Ton OF Pull — TOOL-BELT SIZE!

The New 1000-lb. Mighty Midget Puller

ONLY $31.00
($21.75 for 500-lb. Model)

Combining easy portability with added pulling power, the new Coffing Mighty Midget does more jobs, does them *easier*. Only 9½ lb. in weight, it fits neatly in a tool box or hangs lightly on a tool belt. Full half-ton capacity gives it plenty of power for pulling pistons, removing and installing heavy parts of all kinds, other shop work. Convenient 2-way handle serves as a lever or high-speed crank.

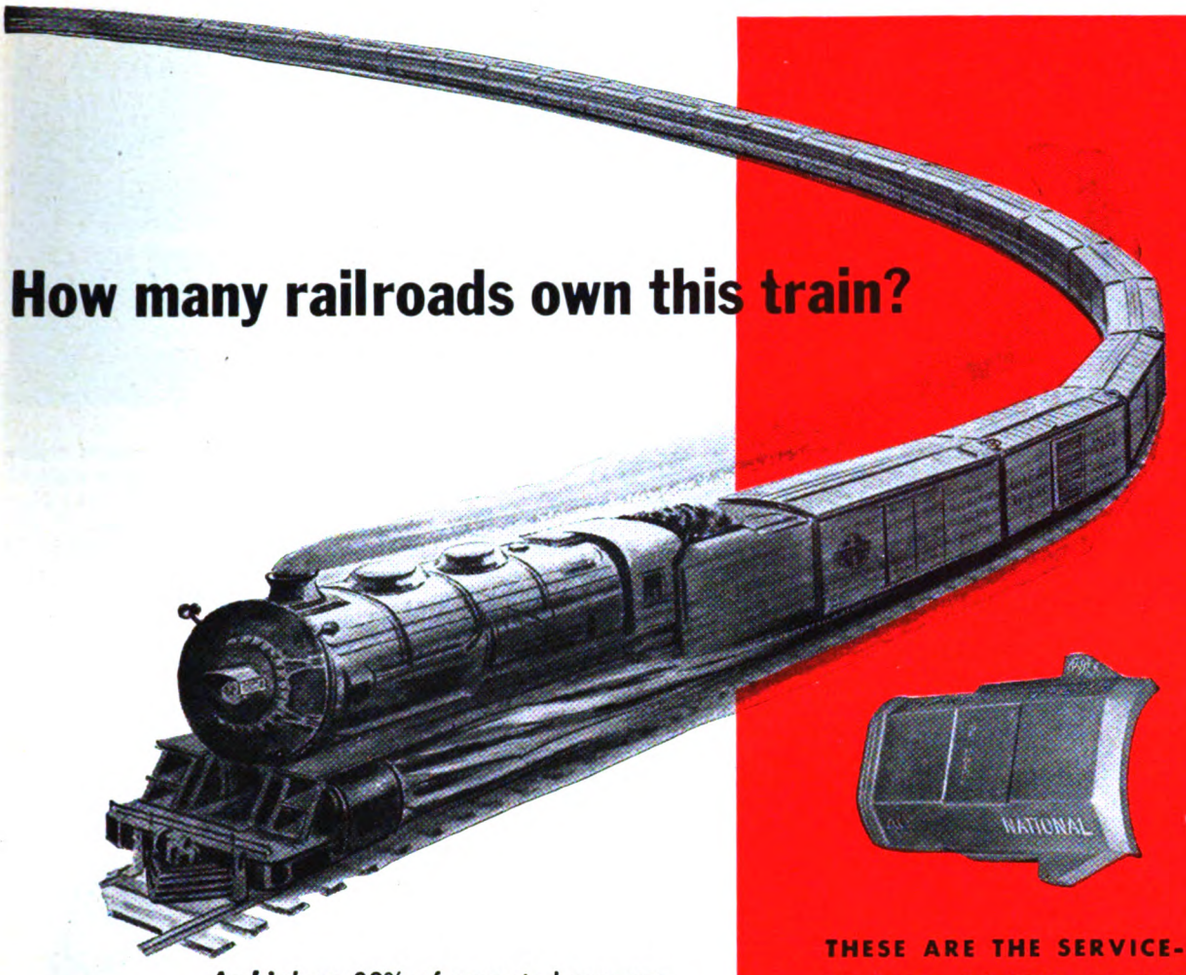
Make the Mighty Midget Puller a standard tool in your shop. See how its added strength and easy portability save muscles while it speeds many phases of maintenance work. Write for Bulletin H2MP.

COFFING HOIST CO.

Quik-Lift Electric Hoists • Hoist-Alls • Safety-Pull Ratchet Lever Hoists • Spur-Geared Hoists • Differential Chain Hoists • Load Binders • I-Beam Trolleys

DANVILLE, ILLINOIS

How many railroads own this train?



As high as 83% of operated cars are foreign — another reason why railroads standardize on SOLID JOURNAL BEARINGS.

A recent study of 6 roads—picked at random—proved that out of every 100 freight cars operated, *from 55% to 83% were foreign!* Think of the resulting interchange problem. Service and maintenance require a tremendous degree of standardization when 8 out of 10 cars belong to other roads. *Free interchange is another basic reason why railroads have so completely standardized on the Solid Journal Bearing . . . for simple, fast, economical maintenance and inspection.* Performance? The performance records of Solid Journal Bearings speak for themselves—with as high as 6½ *Million bearing miles per car set-out!* These performance records are unequalled—and they're constantly being improved. Year after year shows a steady increase in speeds, loading and daily car mileage. That's why railroads will continue to find the answer to dependability, ease of maintenance, operating economy and free interchange in the Solid Journal Bearing.

THESE ARE THE SERVICE-PROVED FACTS ABOUT SOLID JOURNAL BEARINGS

Easiest to Maintain — replacement takes minutes, without need for skilled labor.

More Simple Design — the only answer to unrestricted interchange.

Lowest Cost — save over 25% on car cost; average only $20 per car set in replacement.

Smoothest Ride — lateral movement is not rigidly opposed.

Most Liberal Tolerances — Axles can be used and re-used with simple roller burnishing.

Lowest Running Friction — a single film of oil permits faster acceleration, lower running resistance — particularly at low temperatures.

Lightest Weight — up to 60% less dead weight than any other type of bearing.

National Bearing Division . . . Serving America's Railroads since 1874 with a complete line of Journal Bearings, Engine Bearings and Bronze Parts.

NBM

AMERICAN Brake Shoe COMPANY

NATIONAL BEARING DIVISION

4938 Manchester Avenue • St. Louis 10, Mo.

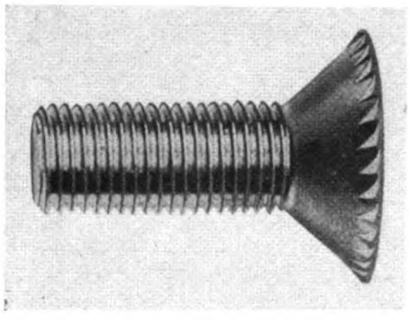
PLANTS IN: ST. LOUIS, MO. • MEADVILLE, PA. • NILES, OHIO • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

"Washer-Less" Screws

Illustrated here is an innovation in screws, named the Spin-Lock by the maker, the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. This screw is available in hex, pan, truss or flat heads which the company recommends for faster, tighter and less costly assembly.

The unusual feature of the screw is its ratchet-like teeth on the underside of the head. This is said to eliminate the time-wasting motion of adding washers.

Being of one piece, with no washer to add, it can be hopper fed. Locking power is positive as there are no parts to cant or fall off. Fastening is neater as the surface is flush and it is safer because there are no protrusions to catch fingers or clothes.





Gondola Lading Band Anchor

Illustrated is a dual purpose development, designed to provide continuous loop locations for sufficient anchorage of lading and to secure and serve as a horizontal reinforcement for the top of car sides.

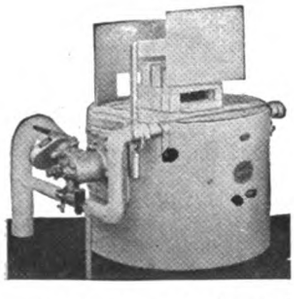
The anchor, made available by the Wine Railway Appliance Company, Toledo 9, Ohio, offers many possibilities. It can be applied to existing gondolas or flat cars and can also be applied in the design of cars to be built.

This anchor is welded to the top coping of the car, eliminating the cost of replacing when the car sides have to be replaced.

On old cars, it is advisable not to replace the original long reinforcement, if any. The anchor chain is simply applied in the most convenient location. On new cars, the product will provide greater horizontal reinforcement per unit of weight when located on the outside edges than any comparative flat bar fastened to the web of the top angle.

It will accommodate bands or wires and has no sharp corners to sever the anchorage.

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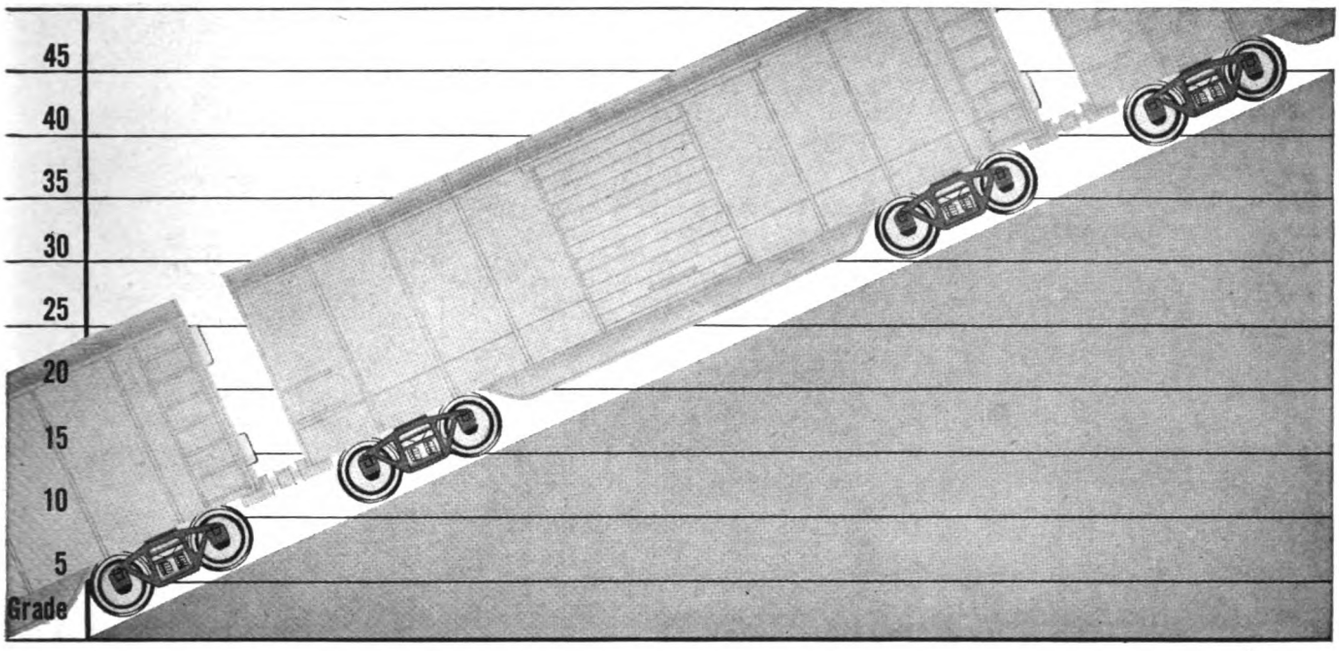
ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT



Pocket-Size Sound Level Meter

Indoor and outdoor acoustics, machinery noise, and hearing requirements may be measured by a miniature sound level meter, made by Hermon Hosmer Scott, Inc., 385 Putnam avenue, Cambridge 39, Mass. Its flashlight size and simple controls allow operation by non-technical personnel. Subminiature tubes and hearing-aid batteries permit a rugged compact design, meeting the specifications of the American Standards Association for sound level meters.

The meter weighs slightly over 2 lb., covers the range from 34 to 140 db. above the standard A.S.A. weighting characteristics which duplicate the ear response at various loudness levels. Batteries have a normal operating life of 50 hours. Optional accessories include carrying case, extension cable with input adaptor, and mount-



Chilled Car Wheels Pull 45% Grade

AMCCW chilled car wheels literally "made the grade" shown above . . . a graphic presentation of the improved performance record of AMCCW wheels over the past 15 years. The base used is car miles per wheel without failure, according to ICC reports. In tabular form, it looks like this:

1935-1939 . . . . . **77,000,000 car miles**
1940-1944 . . . . . **86,800,000 car miles**
1945-1949 . . . . . **111,600,000 car miles**

These averages tell only part of the story. In 1949 the record shows 150,000,000 car miles per wheel without failure, well above the five-year average. The 1950 figure, not yet official, matches this excellent 1949 performance.

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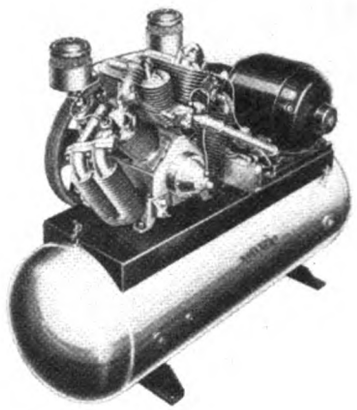
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ing tripod. Vibration pickups and integrators are available for measurement of displacements, velocities, and accelerations in the audio frequency range.

Air Compressors

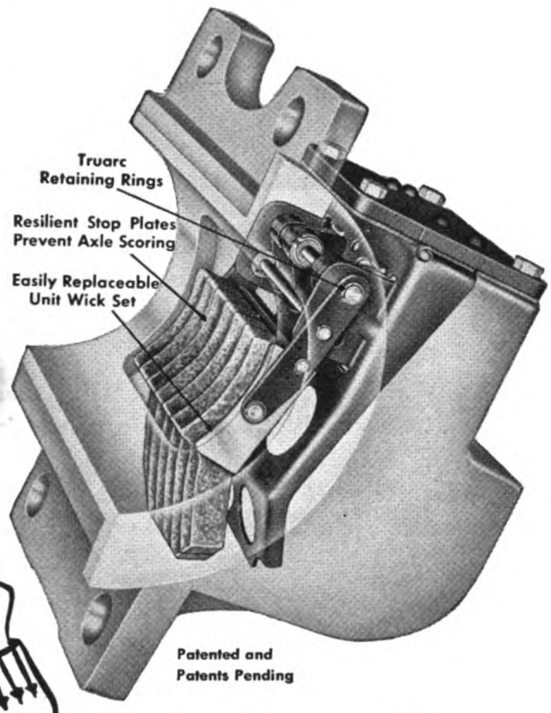
The 3- and 5-hp. compressor units, one of which is shown here, have been redesigned and are different from units of the same size manufactured by the Wayne Pump Company, Fort Wayne 4, Ind. The 3-hp. unit operates at only 455 r.p.m., while the 5-hp. unit has a speed of 650 r.p.m.

Compressors of 3-hp. size are made in both vertical and horizontal types, while the 5-hp. unit is horizontal only. Oil immersed type muffler and filter units are used. Other features include, three matched V belts and a propeller-type flywheel with larger fan blades. The intercooler and aftercooler are directly in the path of air, the cooling system uses oversized copper tubing. A new oiling system assures lubrication even if oil is low in reservoir, avoids over-oiling. The head and cylinder block are removable separately, providing easy access to both cylinders. Screw-feed oil return eliminates gaskets, prevents leaks. Standard with 60-gal. tank either A. S. M. E. as shown or standard tank.



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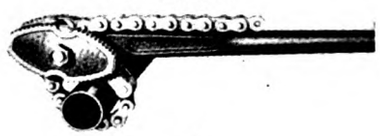
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RAILWAY

Mechanical and Electrical Engineer

MARCH, 1951

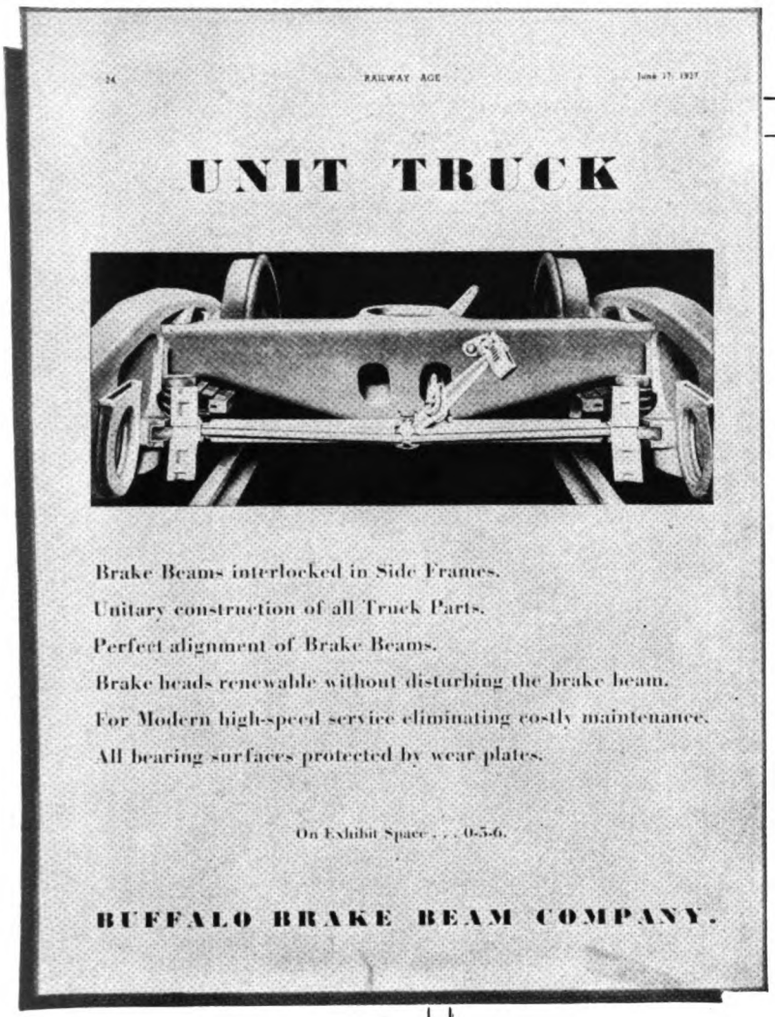
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- ACCOMMODATES BANDS OR WIRES
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24 RAILWAY AGE June 17, 1937

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BUFFALO BRAKE BEAM COMPANY.

Unit Truck's first advertisement, showing a Unit application to a spring-plankless type truck, as it appeared in the June 17th, 1937 Daily Edition of Railway Age.

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Almost two decades ago, when Unit Truck was still on the drawing board, its designers foresaw the trend to the spring-plankless freight car truck. The first Unit Truck ever assembled, which was shown at the Atlantic City Convention in 1937, was of spring-plankless design.

The freight car truck is yet to be built that cannot be made a better truck through the application of Unit brake rigging.

UNIT TRUCK

MARCH, 1951

RAILWAY Mechanical and Electrical Engineer

Founded in 1832 as the American Rail-Road Journal.

VOLUME 125 No. 3

Attention! 1950 Indexes

Please send in your request immediately for the index. Copies are sent only to those who write for them. Those who received the 1949 index are already on the mailing list.

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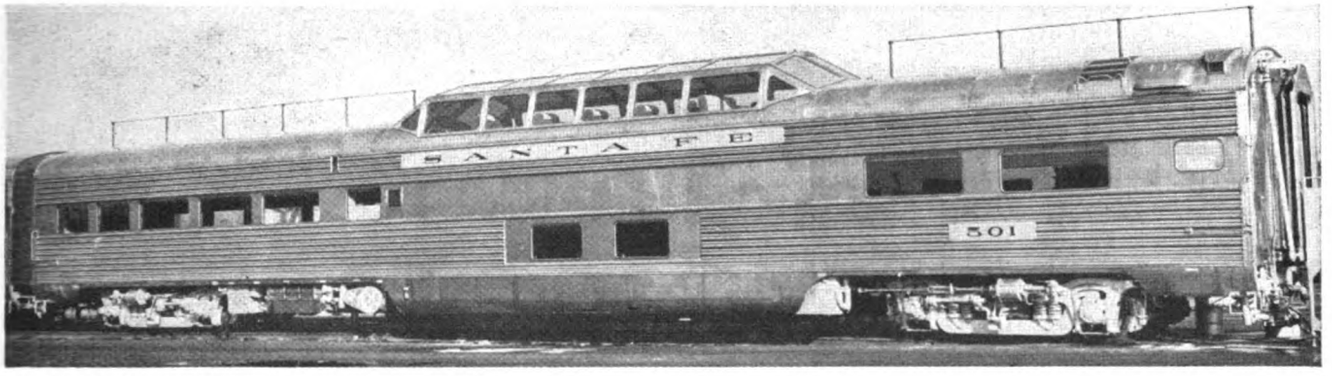
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RAILWAY Mechanical and Electrical Engineer



The dome-lounge car

Dome Cars for the "Super Chief"

Distinctive Turquoise Room proves highly attractive additional feature in car for the Santa Fe

THE Atchison, Topeka & Santa Fe has recently placed in service complete new car equipment for the "Super Chief," including bedroom-roomette cars, drawing room-compartment-bedroom cars, observation-sleeping cars, dome-lounge cars and diners. These cars were constructed by the Pullman-Standard Car Manufacturing Company and the American Car & Foundry Co.

The dome-lounge cars, built by Pullman-Standard, comprise a completely new design including a Turquoise Room seating up to 13 which may be arranged for private dining parties, as an outstanding new feature. Other accommodations in the car include the lower cocktail room and bar with a seating capacity of 10, main lounge room, seating 18; parlor-observation dome seating 16; and a private writing desk room, or five rooms in all. The total seating capacity is 57.

The Turquoise Room is notable for distinctive silver and gold decorative treatment consisting of vinylite on the side and end walls with accordion-type sliding doors covered with the same material in harmonizing color. These doors may be left open, or closed for privacy, whichever suits the occasion. Golden-tint plate mirrors line the side wall above the banquette seating arrangement. Gold-colored-texture draperies are used at the windows and door portieres at one end of the room segregating it from the lower cocktail lounge. The tables can be arranged for cocktail service or dining.

The lower cocktail lounge is modernistic in design. The front of the bar is covered with a vinylite material in a cherry red of quilted design, applied by the use of brass-colored oval-shaped snap-on mouldings, typical of the southwest. A large portion of the side wall is covered with flesh-tinted mirrors which add to the beauty and warmth of the room and give a feeling of spaciousness.

The large main lounge has a new and unique arrangement of furniture. A diagonal seat for card playing with pull-up chairs is located at the forward end of the room. Done in colors of the Southwest, this room also includes two modern sofas along with several lounge chairs and built-in seating units, all of which are arranged to give passengers an unobstructed view of scenery through opposite windows.

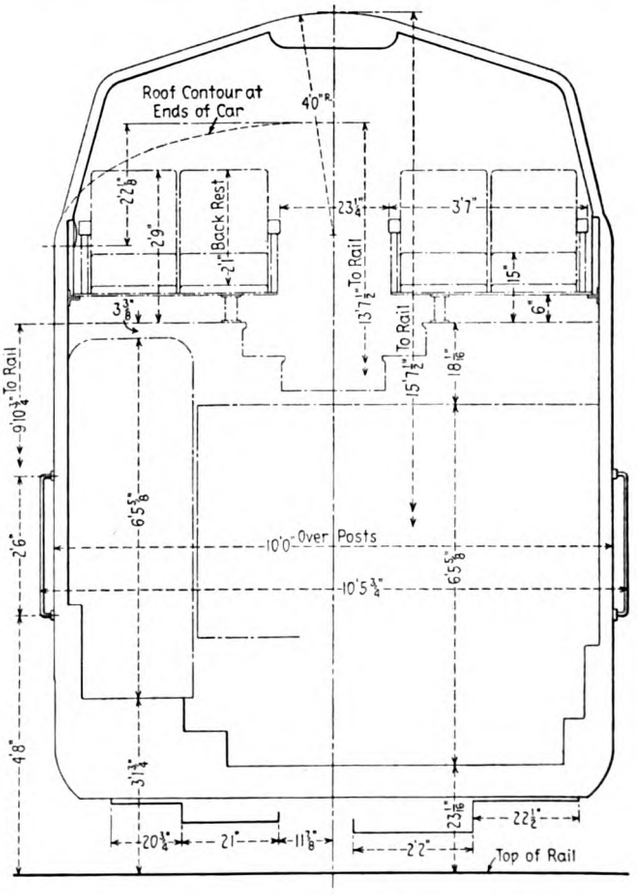
The color scheme used in the main lounge room is also carried out in the dome which utilizes for the first time revolving parlor type seats giving maximum comfort and enabling passengers to view the scenery from every angle.

Dome Car Construction

The cross section outline and floor height of the dome-lounge car is the same as standard lightweight passenger



The seats in the dome (above) are the revolving type. At the right is a cross-section of the dome-lounge car



cars, except that at approximately the center of each car a 2-ft. high dome is added, which raises the roof at this portion of the car to 15 ft. 6 in. above the rail. For the length of the dome compartment, the cars have two levels, the upper level being the floor in the dome, and the lower level depressed into the underframe. The passageway around the lower level is intermediate in height, being connected to the floor level at the ends by means of ramps.

The car is 86 ft. 6 in. over coupler pulling faces and has a distance between truck centers of 61 ft. The height from top of rail to top of floor at the ends is 4 ft. 3 in.; top of rail to top of floor at the lower level room, 23 1/16 in.; top of rail to top of floor at the dome passageway, 8 ft. 8 in.

The general construction of this car employs low-alloy high-tensile steel of riveted and welded design for the car-body framing. Exterior sheathing is of stainless steel with flat surfaces between the windows and on the ends, while fluted design is applied at the letterboard and below the windows.

The underframe is of welded high-strength low-alloy steel. The center still between bolsters up to the lower level under the dome consists of two A.A.R. Z-26 sections, 31.3 lb. per ft., with top flanges welded together continuously. The center sill is welded behind each bolster to a separately-constructed built-up draft sill. At the lower level under the dome, the Z-26 center sill stops and is attached to heavy Z-sections placed crosswise of the car. These beams are connected at the ends (or side posts)

to box-section members which serve as the center sill for this portion of the car.

Construction at the depressed floor under the dome consists of four crossbearers, one located at each end of the depressed portion of the car and two equally-spaced between. End crossbearers are channels, 6 in. by 2 in.; center crossbearers are 6-in. by 4-in. I-sections. At the sides of the car the crossbearers are fitted and welded to built-up I-sections placed longitudinally and extending the full length of the depressed portion. Pressed Z-floor beams (6 in. deep) are placed longitudinally, fitted and welded to the crossbearers.

Superstructure Details

Welded girder-type construction of high-tensile low-alloy steel is utilized in the superstructure. The 2½-in. side sill angles are continuous the full length of car. Side posts, belt rail and window header are 3-in. Z-bars, 2.55 lb. per ft. Side plates consist of two sections for the length of the car.

Side sheets are .075-in. high-tensile low-alloy steel for letterboard and girder sheet, spot-welded to framing members and reinforced with .030-in. corrugated stiffeners spot-welded to the inside surfaces between posts. The entire roof framing including the dome is of welded high-tensile steel. Roof sheets are stainless steel spot-welded to carlines and purlines and riveted to side plates.

The roof over the dome compartment is almost entirely glazed with flat glass sealed units, except for suitable structural members for supporting these glass units. These members are designed so that the glass units can be applied from outside the car and the width of the members is kept at a minimum to give as much glassed area as possible.

Glass for the dome consists of double Thermopane units, supplied by Libby-Owens-Ford. The outside light of each unit is ¼-in. heat-absorbing polished plate glass and the inside light uniform ½-in. laminated safety polished plate glass.

The entire floor area is covered with a lightweight composition applied to Keystone sheets of zinc grip steel resting upon pressed Z low-alloy high-tensile stringers.

End Equipment—Insulation

Couplers are of the Americal Steel Foundries' controlled-slack Type E, made of high-tensile steel, as are the coupler yokes. Draft gear are Miner Type A-4X-B, and the lower buffing mechanism, Miner Type B-18X. The buffers are a built-up design having side stem spring and center stems and being carried on the end structure by adjustable extension rods. A Fowler improved buffer is also installed. Morton end diaphragms are of the two-fold U-shape type. In conformity with Santa Fe practice, no use is made of contour closures.

The car bodies are insulated with Johns-Manville Type A Stonefelt 3 in. thick having asbestos flame-proof sheathing on both sides, and applied to the sides, ends, roof and top of the false floor. Stainless steel wiring is used to hold the insulation in place except in the floor. Sides, ends, roof and sub floor have Insulmat sprayed on ¼ in. thick (dry measurement) for sound-deadening purposes.

Electrical Equipment

The electrical system is derived from a 10-15 kw. Frigidaire-type diesel alternator unit, mounted underneath the car and consisting of two direct-connected alternators. Alternator 1 supplies 10-kw. 114-volt current for lighting, small appliances and the evaporator blower motor, and Alternator 2 supplies 15-kw. 210-volt current for the air-conditioning system. Each car is supplied with a 150-gal. heavy-gauge steel tank applied underneath the car for storage of fuel for the diesel engine. Electric power for emergency lighting and engine starting is supplied from a 32-volt storage battery, which is charged from a direct-current exciter belted to the main engine drive shaft.

The heating system utilizes Vapor narrow unit-fin radiation. The equipment includes a vertical-type solenoid valve, latest-type loop equipment and zone control heating arranged with individual circuit for each portion of the car on the various floor levels.

The main trainline is of 2½-in. extra heavy steel pipe, insulated with Johns-Manville asbestos sponge-felted pipe covering and protected with an outer covering of .040-in. galvanealed steel.

Air conditioning is of the Frigidaire type, 10-ton capacity, split into two 5-ton units applied overhead in car body which completely air conditions the car, including the dome. The air is distributed by air ducts of .030-in. thick Everdur, insulated with 1-in. thick Stone felt Type A insulation cemented to the ducts and all joints sealed with tape. The circulating air grille is Barber-Colman multi-louvre register with lint screen. Fresh air filters are Farr type. The car is also equipped with four Dorex absorbers.

Westinghouse air brake equipment is the modified H. S. C. control with a generator-type speed governor, and arranged for future application of electro-pneumatic brake control. The air reservoirs are of lightweight steel and the brake pipe is hard copper tubing with sweated copper fittings. For connection to valves and reservoirs, flange fittings are used, with threaded connections to facilitate disconnecting. A Peacock hand brake, furnished by the National Brake Company is of the pumphandle type, applied at the dummy end of the car.

The windows in this car are equipped with Adams & Westlake aluminum breather type sash glazed with Pittsburgh Plate Glass Company's safety glass on the inside and clear plate glass on the outside.

Trucks

The trucks are General Steel Castings four-wheel type with 9-ft. wheel base and I-beam equalizers. They are equipped with bolster anchors, inverted center plates and bolster roll stabilizers, Houdaille vertical and lateral shock absorbers, brake beam stabilizers, Sante Fe standard side bearings and truck-mounted brake cylinders. The frames and bolsters are of cast nickel steel.

The wheels are of Standard Steel Works manufacture, 36½ in. diameter with A.A.R. cylindrical treads, mounted on 6-in. by 11-in. straight center axles, machined all over and having ground journal surfaces. Timken roller bearings and boxes are fitted on all axles. Four journal boxes are arranged for Westinghouse decelostats and one for speed governor control. All are equipped with hot box odor alarm.

Double coil springs are furnished by the American Steel Foundries for both bolster and equalizer springs. The Simplex unit-cylinder clasp brakes are designed to develop a total braking power 250 per cent of the lightweight of the car at 100-lb. cylinder pressure.

The dome-lounge car has an average total weight of 154,958 lb., of which 41,850 lb. are in the trucks. The diner has a total weight of 143,514 lb. The trucks of this car weigh 41,750 lb.

Controls for Heating and Air Conditioning*

An insight into the specific problems of train heating and air conditioning and the equipment involved for proper functioning

By Norman O. Kirkby†

THE FIRST passenger diesel locomotive presented a major problem in heating. The steam locomotive had been an almost inexhaustible source of heat, limited only by pressure and the size of the steam distribution lines. While a large amount of heat was present on the diesel and wasted to the atmosphere through the radiators and exhaust manifolds, no practical method of harnessing this heat was, or is known, within the limitations of size and weight restrictions. As all railroad cars were heated by steam, some source of steam was necessary.

It was necessary to find a new method of generating steam and an entirely new concept of steam generation resulted in the first successful straight through steam generator. Such a generator had definite advantages over a conventional boiler. Since no water level is maintained and no water drums are used, the size of the water containing portions may be reduced to a minimum, consistent with high heat exchange practice. The small volume of water gave other advantages of safety. The mass of water in the coils at or near vapor temperatures is so small that a complete rupture of the coil may occur without any possibility of a steam explosion. Since cubical size was extremely limited, combustion volume was likewise limited and heat release per unit of combustion volume had to be increased greatly over standard practice. It was felt that such intensity could be achieved by burning in a high pressure chamber. Heat release on these generators is in the neighborhood of 1,000,000 B.t.u. per cubic foot of combustion space, approximately twenty times normal practice. A typical steam generator in use on diesel locomotives has a normal rating of 4,500 lb. of steam per hour and is capable of a maximum output of 4,800 lb. of steam per hour.

These generators are continuous coil type steam generators, down fired with the same diesel fuel as is used on the power engines. Sizes range from 500 lb. of steam per hour to 4,800 lb. of steam per hour at varying pressures from 75 to 300 lb. per square inch. Steam quality is in the neighborhood of 99.8 percent. Feedwater is pumped by semi-high speed triplex pumps to a water pressure regulator which bypasses water when steam pressure is within the control range. The water flows from the water pressure regulator to a hydraulic servo mechanism that proportions fuel and air to the volume of water passing through the control. Here then is the major difference between a steam generator and conventional boiler. Water must be fed to the generator in exact accordance with steam demand, and practically all water entering the generating coils must be converted to steam in a single pass. No water level is maintained, therefore, flow controls must be used to regulate water, fuel and air. The volume of water flowing through the water portion of the servo control positions an oil valve which operates the hydraulic mechanism. Hydraulic pistons position a double cam plate to increase or decrease fuel and air. The double cam plate through a sleeve valve balances the hydraulic pistons to bring the system to equilibrium. The water then enters the steam generating coils where it is converted to steam. Any excess water is removed by a centrifugal steam separator to insure dry steam. The excess water, traveling at high velocities through the coils, carries the scale forming sludge into the separator where it is separated and wasted to the ground by automatic periodic blowdowns.

Atomization is by compressed air and a high pressure fan furnishes combustion air. A steam temperature limit control meters oil to the burner nozzle if lack of water causes superheating. Standard safety controls are used and A.S.M.E. practices and codes are observed throughout the manufacturing procedures. Thermal efficiencies are approximately 82 percent.

The rules governing enginemen and firemen prohibit the fireman from leaving the cab of the locomotive when the train is in motion. Therefore, all controls must be entirely automatic and in addition, remote alarms are used to indicate any failure of the generator or its appliances. Shut down of the unit upon arrival at terminals is accomplished by remotely operated valves which shut off the main steam line and, in turn, cause the generator to reduce its output to zero.

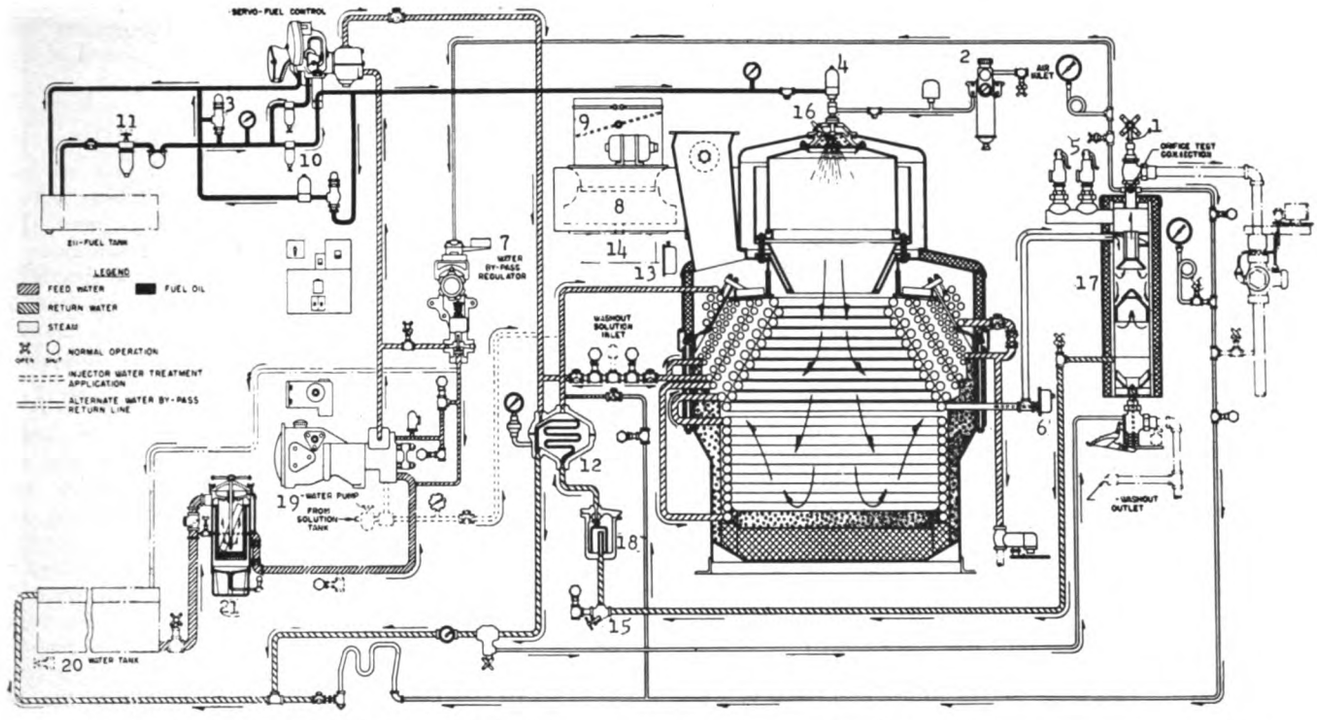
Maintenance periods may well be irregular and at extended periods, some railroads covering 5,000 miles of operation before bringing the locomotive into a terminal for maintenance. For this reason preventive maintenance is practiced and routine work highly systematized.

Other Heat Sources

Other sources of heat have been used for railroad cars, some aimed at relieving the diesel locomotive from the problems of carrying water necessary for the pro-

* Abstract of a paper presented before the American Society of Heating and Ventilating Engineers, Philadelphia, January 1951

† Executive Engineer, Vapor Heating Corporation



Stop and check valve (Closed during start or shut down procedure)	1	Blower	8	Spark plugs	16
Atomizing air pressure regulator	2	Damper	9	Steam separator	17
Fuel pressure regulator	3	Fuel filter (pressure line)	10	Steam trap (return water line)	18
Fuel solenoid valve	4	Fuel filter (suction line)	11	Water pump	19
Safety valves	5	Heat exchanger	12	Water tank	20
Steam temperature limit control	6	Ignition transformer	13	Water treatment tank (strainer tank only if injector system is used)	21
Water by-pass regulator and switch	7	Motor converter	14		
		Return water strainer	15		

Piping diagram of Vapor-Clarkson steam generator, OK-4625 series

duction of steam and the additional fuel necessary for the steam generator. Others have been the outgrowth of electrical capacity problems. The advent of the modern high speed, light weight, passenger car has brought increased competition between neighboring rail lines. More and more consideration is given to passenger comfort and increased use of electrical equipment has been the result. Capacities of air conditioning equipment have increased from 5 and 6 tons to from 7 and 8 tons per car. Better lighting and more of it has been used. Radios, record players and intercommunication systems have imposed increased electrical loads. Diners are being built with entirely electrical kitchens. This constant increase in electrical load has increased the sizes of axle driven electrical generators to their limit. Axle load limits have been reached and alternate sources of electrical energy are being sought; on long transcontinental trains frequently a major portion of one diesel engine driven, have been used, but the problems erators and the locomotive contributes relatively nothing to the total tractive effort of the locomotive combinations.

In some cases head end electrical generating plants, diesel engine driven, have been used, but the problems of transmission between moving cars have not been satisfactorily solved.

More and more applications of individual engine generator sets on passenger cars are being made to solve the problems of increased electrical loads. Propane engines are used on some railroads for generating electrical energy and also for air conditioning. Much work is being done at the present time on diesel engine generator sets and in some of these cases, the waste heat from the diesel engine is being recovered. In some applications, the coolant water of the diesel engine is used as the heating medium within the car. In other applications, a liquid-to-liquid heat exchanger is used to heat water or a mixture of water and ethylene glycol which in turn is used as the heating medium. The largest single electric load is the air conditioning system, therefore, there is excessive capacity during non-air conditioning seasons. The energy may be used during the heating season as an auxiliary source of heat.

Thermostatic controls are arranged to use the available heat in predetermined sequence. First, electrical current is used either by strip heaters in the overhead heating system or immersion heaters to heat the heating fluid. This insures maximum loading on the diesel engine. Next, full use is made of the heat wasted to the coolant with thermostatic controls insuring constant engine manifold temperatures. Finally, the waste heat in the engine exhaust is used by means of a gas to liquid heat exchanger controlled by a by-pass butterfly valve in the exhaust line. The sizes of the engine generator sets used range from 20 to 35 kw. but full use of all recoverable heat will not satisfy the full heat load in colder climates and steam must still be used to supplement the engine heat unless an oil-fired water heater is used to make up any deficiencies. Such a heater may be used alone as the heat source, or in conjunction with the heat from the axle generators or engine generator sets.

Another solution to the problem of furnishing an in-

dividual source of heat for each car has been proposed and is being studied and tested at the present time. This is an offshoot of the so-called vapor phase system as applied to internal combustion engines. It consists generally of operating the engine at coolant manifold temperatures above the vapor temperatures at atmospheric pressures. The coolant flowing from the engine would be allowed to flash into steam and the steam condensed either in the heating system or under-car condensers. Higher engine efficiencies would result as well as increased overall thermal efficiency of the system. Pump heads seem, at the present, to be the limiting conditions when handling very hot liquids. There are also problems to be studied concerning the coring of the coolant water through the cylinder block of the diesel locomotives to avoid cavitation of the hot coolant liquids.

At present approximately 95 per cent of all passenger cars are heated with steam, therefore, its distribution and control are the major considerations of all railroad heating and air conditioning engineers. One diagram shows a typical steam heating layout for a coach. High pressure steam is transported through the cars by 2½-in. main steam lines and through flexible metallic conduits between cars. Steam pressures vary from 125 to 250 lb. per square inch. Total steam demand is greatly in excess of the total of the heat demand of the individual cars. The calculated heat loads of individual modern passenger cars at —20 deg. F. with a 40 m.p.h. wind is approximately 180,000 B.t.u. per hour, or about 185 lb. of steam per hour. Actual tests indicate steam consumption may be as high as 350 to 400 lb. of steam per hour per car. The difference in these figures is the loss due to main steam transmission lines and flexible metallic conduits, this loss increasing as temperature gradients increase.

The high pressure steam is reduced in pressure and fed thermostatically to the radiation at pressures from 3 to 12 lb. Condensate is wasted to the ground at temperatures of approximately 200 deg. F.

Control Problems Difficult

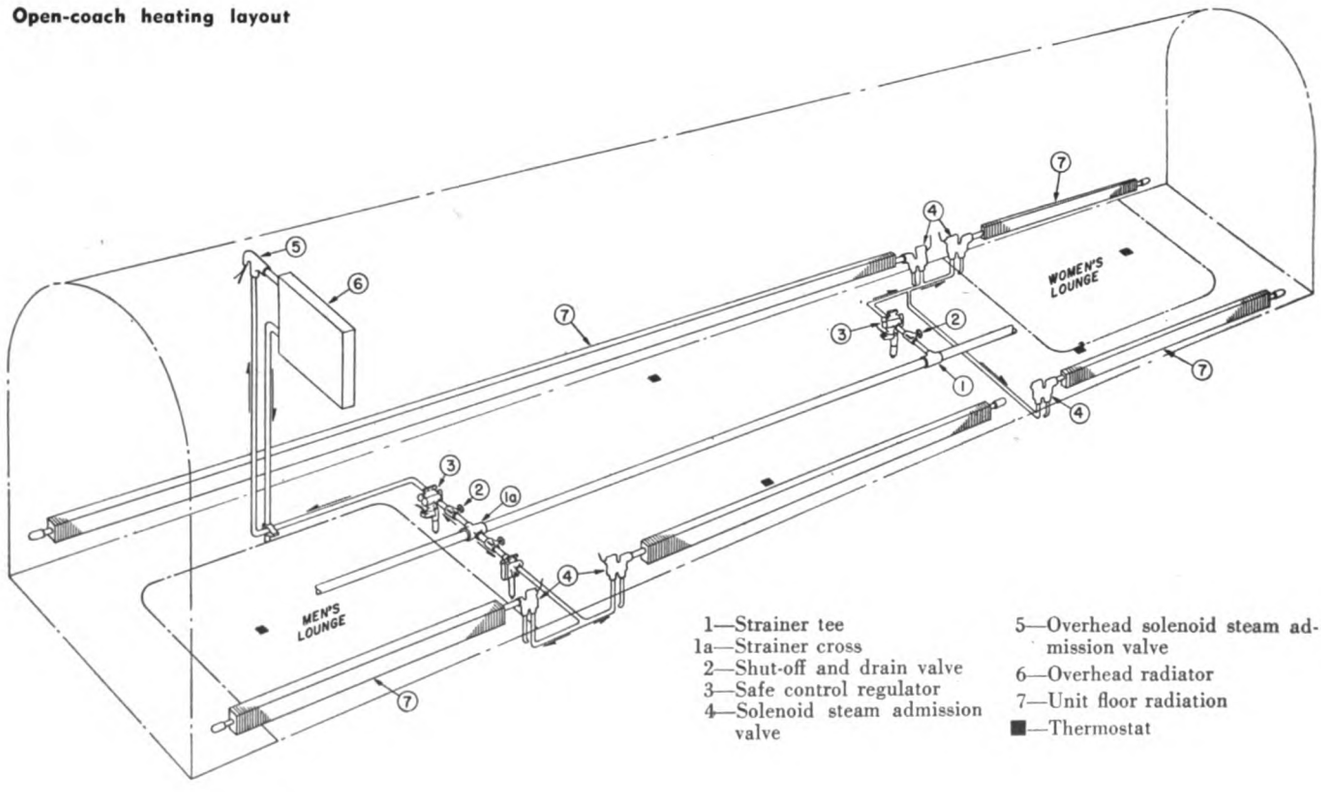
Nowhere in industry does the heating and air conditioning engineer have more difficult problems to solve and more precise control specifications to meet. The space to be controlled is exposed on all six sides. It may be, and is propelled through space at speeds up to 100 m.p.h. The same required equipment must be able to operate and control continuously from temperatures of 120 deg. F. in desert areas to —60 deg. F. in Canada or the Pacific Northwest.

Only one manual switch is used on the majority of passenger cars. This is a simple OFF and ON switch. Thermostatic controls determine whether the car will be heated, ventilated or air conditioned. A 1-deg. ventilating dead band is usually used between heating and cooling, although cooling will extend into the heating band. For example, a car will be heated to 75 deg. F., ventilated to 76 deg. F. and air conditioned from 76 deg. F., although the car may be cooled down to as low as 68 deg. F. It is evident that controls must respond within less than ±0.5 deg. F. to avoid hunting from heating to cooling and the reverse. An outside thermostat is used for positively locking out the compressor circuits when outside ambient temperatures are above a predetermined level.

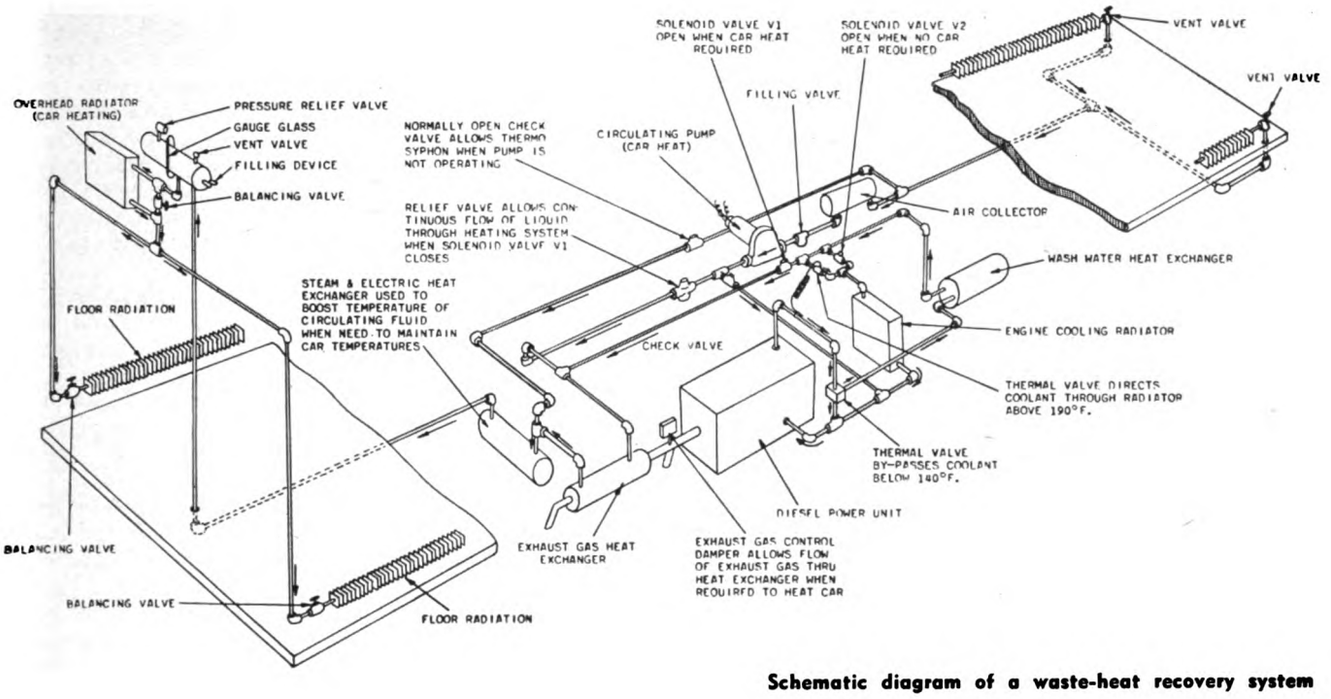
Car Heating Design

The heating system of a railroad car may be divided into three separate parts: an overhead forced air system, a side wall radiation system, and the radiant heating at the floor line.

Open-coach heating layout



1—Strainer tee
1a—Strainer cross
2—Shut-off and drain valve
3—Safe control regulator
4—Solenoid steam admission valve
5—Overhead solenoid steam admission valve
6—Overhead radiator
7—Unit floor radiation
■—Thermostat



Schematic diagram of a waste-heat recovery system

The overhead forced air system is usually designed to take from 25 to 50 percent outside air, filter it, heat or cool it, and deliver it to the car through aspirating or diffusion type of outlets. With increases in air conditioning capacities, volumes of air have increased to avoid frosting of the evaporator coils. Air handled has increased from an average of 1,500 c.f.m. on pre-war cars to 2,400 c.f.m. on postwar cars. Since duct sizes have remained relatively fixed, velocities have increased and air temperatures must be held fairly constant at the outlet to avoid hot and cold drafts. On pre-war cars air intake hoods and filters increased in static pressure with the speed of the car and the result generally was 100 per cent recirculated air at speeds of 50 m.p.h. and over. Since the war, intake hoods have been designed with a fairly even static head resulting in use of outdoor air at high speeds and increasing the total heat demand of the system.

If outdoor air intakes do not function at high speeds and exhaust fans are used, it is evident that a negative pressure might result in the car body and that is the case in a large proportion of the present railroad cars. Air leakage is increased tremendously and difficulty is encountered in keeping end doors closed. The problems imposed on the control system under these changes of air distribution require careful study and extreme accuracy to overcome. To overcome the problems of negative pressure and the resultant dirt problem, some cars have been pressurized to insure correct air distribution and cleanliness. The plenum chamber is sealed and no exhaust fans are used. Leakage stacks provide air outlets and air pressures of fractions of an inch are maintained throughout the car body.

All types of filters have been used including electrostatic, centrifugal and activated carbon. Those filters used most generally, however, are the wire mesh oil dipped type.

The increasing volumes of air handled in overhead systems has increased heating coil sizes from a pre-war average of about 58,000 B.t.u. per hour to about 100,000 B.t.u. per hour on new cars.

Even with the increase in volume, velocity and heat input in the overhead system, tests prove conclusively that the overhead air stream cannot penetrate to the floor line of the cars without raising discomfort levels to unbearable limits. It must be remembered that conditions in railroad cars differ radically from those encountered in industrial or domestic service. Passengers sit next to, or in actual contact with, cold external walls and windows. Distances from air outlets to passenger contact are at a minimum. Outlets may be directly over the passenger at a distance of five ft. from the head level when seated. The inability to penetrate to the floor line necessitates the use of other heating systems to insure warmth at external walls and floor line.

A side wall heating system consisting of finned radiation is used to insure a vertical film of hot air along the side walls of the car. Such a system has been used for many years in railroad cars and while the full value of the system was not realized, its use became almost universal.

Before air conditioning became widely used, windows on all railroad cars were single glazed and also storm windows were used in cold weather. At that time, windows were approximately 40 per cent of the side wall of the car adjacent to the passengers. These windows had large leakage factors and a high velocity vertical air film was the only method of counteracting such heat losses. Today windows make up approximately 80 per cent of the car side wall exposed to passengers, but are double glazed and are well sealed in rubber. Radiant losses and gains have replaced the convectional losses and different methods are used to counteract these losses. In addition, heat distribution is better understood and may be more closely calculated.

Today the action of the side wall radiation is divided into two functions, that of convectional currents rising vertically along the outside wall and the radiant heat

radiating in straight lines from the radiator guards in the form of infra-red rays.

It can be visualized then, that the air currents in the confined 10 ft. wide space of a railroad car are at right angles to each other. A main air stream from the overhead system follows a path longitudinally of the car body and the convectional air currents from the side wall radiation move transversely and at right angles to the main overhead stream. These air movements become more complicated in multiple room cars but the main streams will retain their individual characteristics.

At one time it was felt that the convection currents from the side wall radiation kept the ankles and feet of passengers warm. It is now realized that the air currents moving from the aisle toward the side wall radiation must of necessity, be considerably cooler than the warm air delivered from the overhead system or the air rising from the side wall radiation. Today the value of infra-red radiation is fully recognized and indeed the raising of mean radiant temperatures to comfort levels has been a goal for some years. In 1934 the warm air from the side wall radiation was first used behind wainscot sheets being released at the window sill, thus giving a radiant shield between passengers and side walls and making effective a film of rising warm air on the inside of the windows. Today many cars are making use of such panel heated construction to improve heat distribution and increase the efficiency of the heating system.

Zoning Necessary

In addition to the foregoing problems which must be solved by the control engineer, it has been found necessary to zone individual cars. End doors of the cars are constantly being opened, thus allowing cold air currents to enter the car body. This is especially objectionable at the non-recirculated end of the car where these cold air currents may easily affect passengers adversely in the first two or three seats. For this reason, radiation at the end of the car is controlled separately by thermostats in that zone. In addition, lounge rooms for men and women are zoned separately as well as individual rooms in multiple room cars.

Additional zoning is used on many railroad cars which travel from east to west across the country and from north to south on long trains. Here recognition is given to the differences between sunny and shady sides of the car, and, consequently, thermostats on each side of the car regulate the amount of heat input to the car in accordance with radiant heat being added to that side of the car by sun effect. A particularly difficult problem in radiant effect is found in the dome cars, now being used on many of the railroads. These cars are double-deck cars with the upper deck being in the form of a bulge at the roof line, the outer skin of the bulge being approximately 95 per cent glass. Here radiant effect of sun can influence greatly the heating and air conditioning loads in the car, and thermostats sensitive to radiant heat are used to adjust the normal car thermostats to balance the heat input to the radiant heat imposed on the car structure.

Thermostatic control theories are fairly well defined although changes in seating arrangements and partition locations constantly must be analyzed anew. In general, it is well accepted that the overhead heating system must be fully used at all times to conform to the standards of ventilation set up by the U. S. Public Health Service. Thus the overhead system is used to heat the car until outside conditions, as indicated by inside temperatures, indicate the need for additional heat requirements from the side wall heating system. To accomplish this, side wall heating is tied in thermostatically to the overhead system and cannot be used except when a call for heat is recognized by the overhead heating thermostats. Such a system insures balance of heat and allows temperature levels to be maintained with 1 deg. bands from end to end of the car and from floor to ceiling.

Bimetallic thermostats do not have the precision of control necessary for railroad requirements, nor will they stand the high vibration and shock conditions encountered. A mercury thermostat specially designed to meet these conditions is used almost universally for control. Where extremely cold temperatures are encountered, a mercury thallium amalgam is used in place of pure mercury in the thermostat. A unique feature of the thermostat is the fact that a secondary mercury bulb may be used. This bulb is wrapped with a resistance winding and insulated to be unaffected by ambient temperatures. The result is a thermostat which may be influenced by ambient temperatures or by artificial heat applied electrically through the resistance winding of the secondary bulb. The secondary bulb may be used in two ways. A steady amount of current may be imposed on the heat winding to set the thermostat down below its fixed temperature setting. Thus an 80 deg. thermostat may be used as a 78, 76, 75 deg. thermostat eliminating the need for an infinite number of fixed setting thermostats. By using a potentiometer in series with the heat winding, a controllable thermostat is obtained.

The heat winding on the secondary bulb may be used in another important fashion. By placing a resistance in parallel with the fixed resistance used for set down and having this resistance cycled by the relay operated by the thermostat, additional heat may be imposed on the secondary bulb when the mercury column is not in contact with the control point. When the mercury is in contact with the control point, a relay cuts out the cycling resistance and allows ambient temperature to affect the thermostat alone. By weighting the cycling resistance to the latent heat in the radiation being controlled, the heat input may be shut off at a point where the remaining latent heat in the radiation will bring the temperatures to the control point without overruns or underruns. While many thermostats now use this feature, basic patents restricted its use to such mercury thermostats until recently.

Mercury thermostat-relay combinations control solenoid steam admission valves, electric strip heaters, oil fired heaters and, through interlocks, control the air conditioning equipment.

Air Conditioning Systems

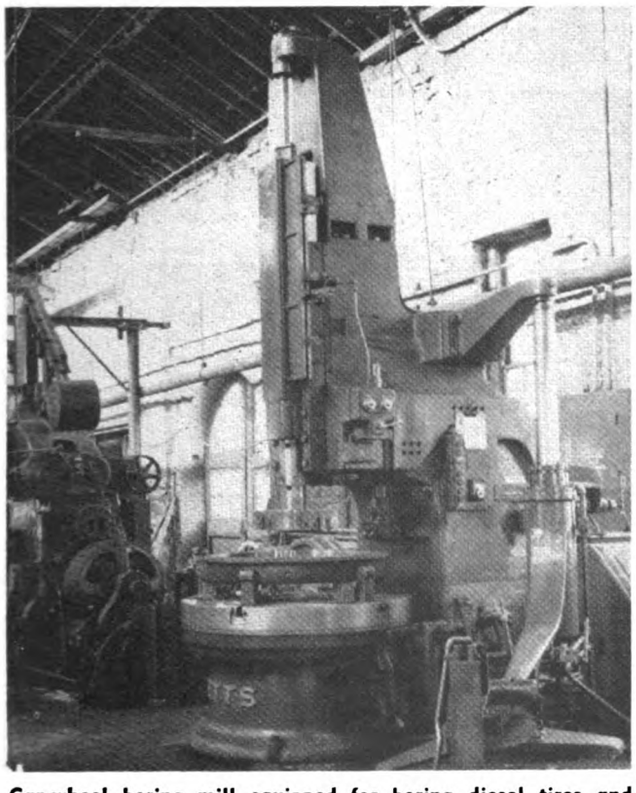
While electro-mechanical air conditioning equipment is most widely used, there are many cars equipped with steam jet systems and many which still use ice activated systems. It has been found that, generally, dry bulb control will give satisfactory results although reheat has been used in several ways. Overhead steam radiators have been used as well as electric strip heaters. In some cases reheat is under control of the occupant of a single room by means of a small electric heater in the duct outlet of the individual room. In addition, wet bulb control has been used in some cars and combination wet and dry bulb control has been used.

Diesel Tire Turning On Car Wheel Boring Mill

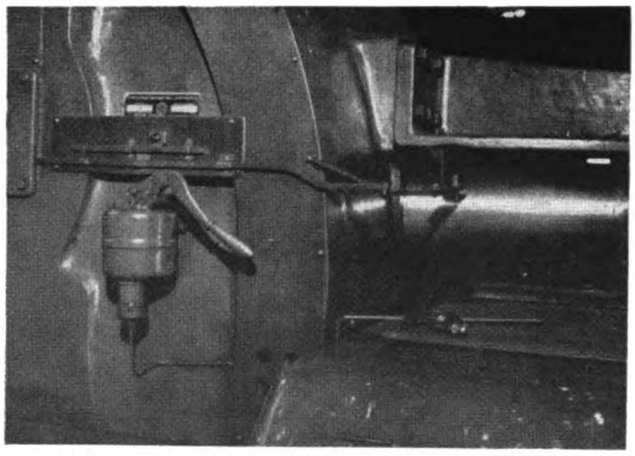
Additions made to a car wheel boring mill at the Bloomington, Ill. shops of the Gulf, Mobile & Ohio consist of an extension head on a 6½-L boring bar which permits boring diesel switching locomotive tires and machining diesel wheels. The primary purpose of installing the extension head was to eliminate the need for retaining a tire turning lathe after the G.M.&O. became fully dieselized. Experience with the arrangement has shown, however, that this method is faster and it does a better job. The double-tool arrangement used results in tires bored to within .001 in. out of roundness and .001 in. straightness. In over two years there has been no loose tire trouble.

The extension head is mounted to the vertical boring bar with a light press fit, approximately 500 lb. It is secured with two keys made from tools, and with two set screws. The tools are adjusted for different boring diameters by taper blocks on each end. Carbide tools are used with a speed of 15 r.p.m. and a feed of .030 in. The tires are bored to snap gauge limits with a tolerance of .004 in.

The second addition permits turning, facing and boring wheels on the one machine by machining the diesel wheel inside and outside hubs with a facing bar. An adjustable stop for the horizontal or facing ram is incorporated on one side of the machine. This is a bell crank leverage which stops the travel of the ram at the desired point, which point is set by individual gauges for different size wheels. Each gauge allows for the diameter of the vertical boring bar and enough more to face out to the outside circumference of the hub. The gage is used to set the top bar on the adjusting leverage, and an arrow on the bottom bar is brought in line with a mark on the top bar.



Car-wheel boring mill equipped for boring diesel tires and facing inside and outside hubs



The bell-crank arrangement for controlling the travel limits of the facing ram. When set by a gage used on the vertical boring bar, the pointer near the ram is moved axially along the ram to the point at which the travel of the ram is to be stopped

The sequence of operations on the modified mill is:

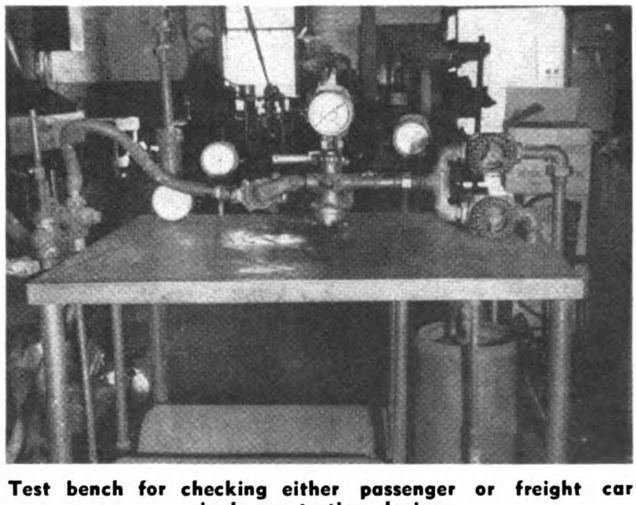
(1) Turn outside, or water guard, hub; (2) Face outside hub; (3) Turn wheel over; (4) Face and bore wheel; (5) Set the turning jig and turn the hub for the grease guard, or inner hub.

Test Device Tester

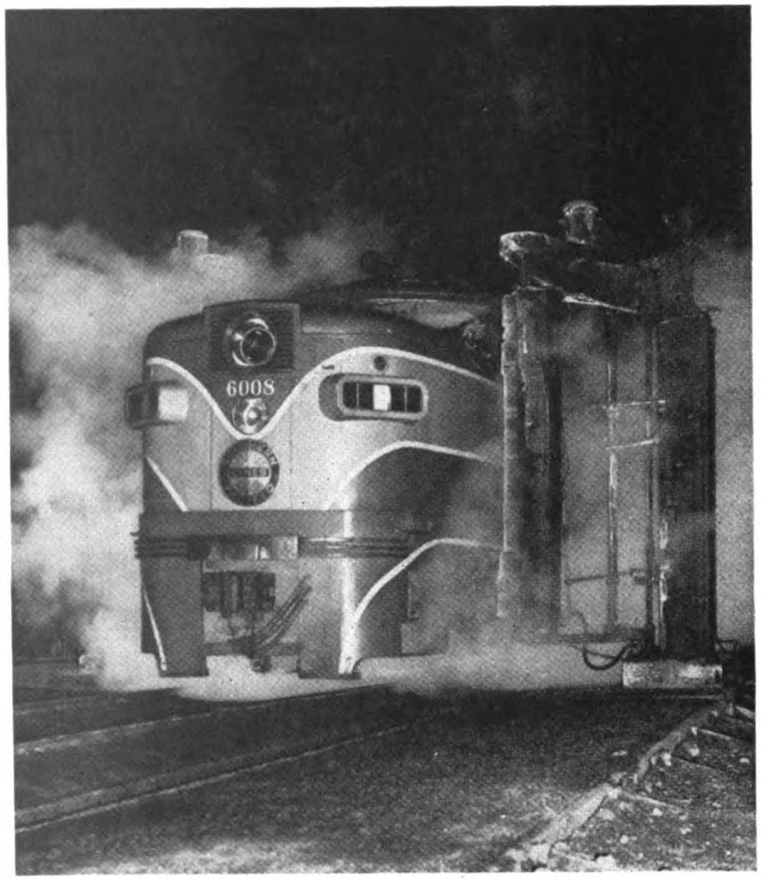
The Chicago Great Western makes the required checks on single-car testing devices at Oelwein, Iowa with an arrangement which is suitable for testing either freight or passenger car testing devices. The testing arrangement gives an orifice test to see that the proper pressure drop occurs in the required time. The arrangement also tests pipe leakage.

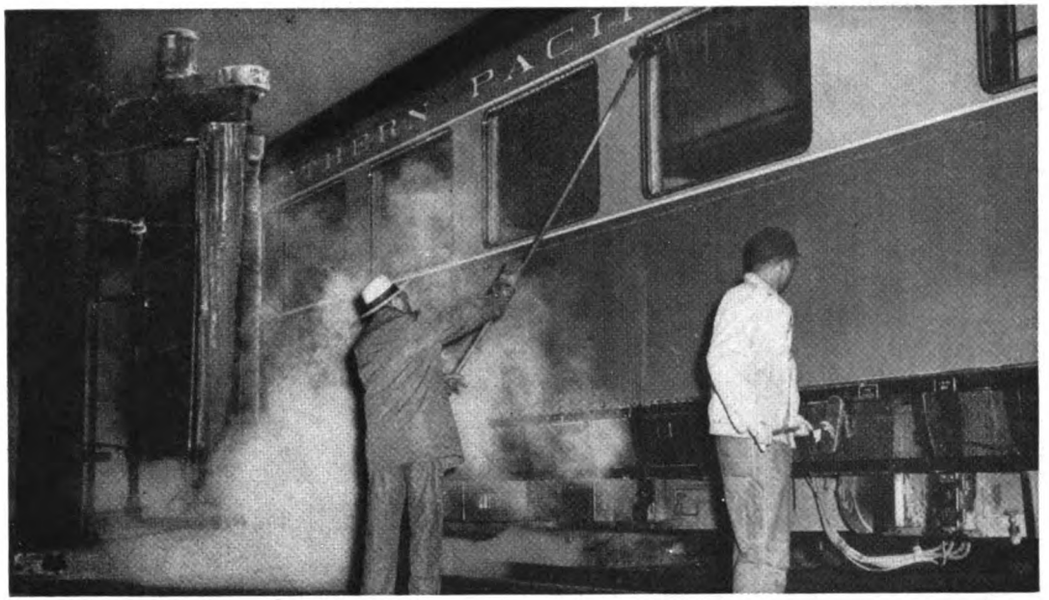
The bench is equipped with a timer and all necessary gages. Three reservoirs are mounted underneath the bench to provide the two different reservoir capacities required for testing testing devices.

The operation of the testing bench for changing from passenger-car to freight-car single-car testing devices is simple. To test the passenger car apparatus the top valve is closed and the bottom valve opened. Freight car testers are checked by closing the bottom valve and opening the top valve.

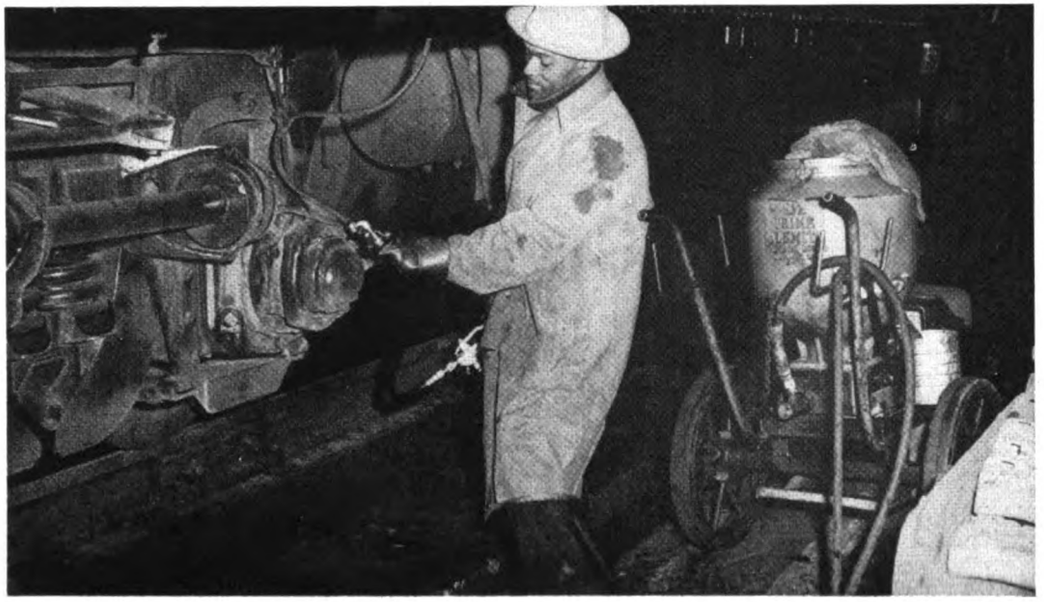


Test bench for checking either passenger or freight car single-car testing devices





The diesel power unit, uncoupled from the cars, is sprayed with a mild acid solution as it is run through the mechanical washer (left). Under parts are steam cleaned and thoroughly water rinsed. These operations require about 8 min. During the next 27 min. the cars pass through the washer. Below: lubricating the truck journal boxes

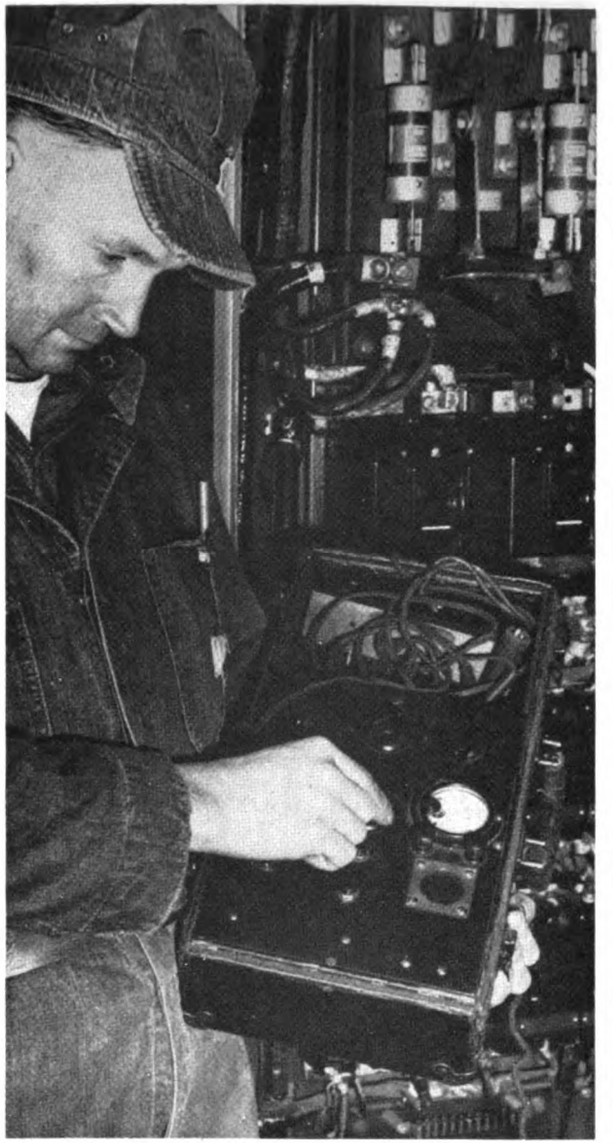


Cleaning and Servicing The "Shasta Daylight"*

* From an article prepared for the Southern Pacific Lines Bulletin

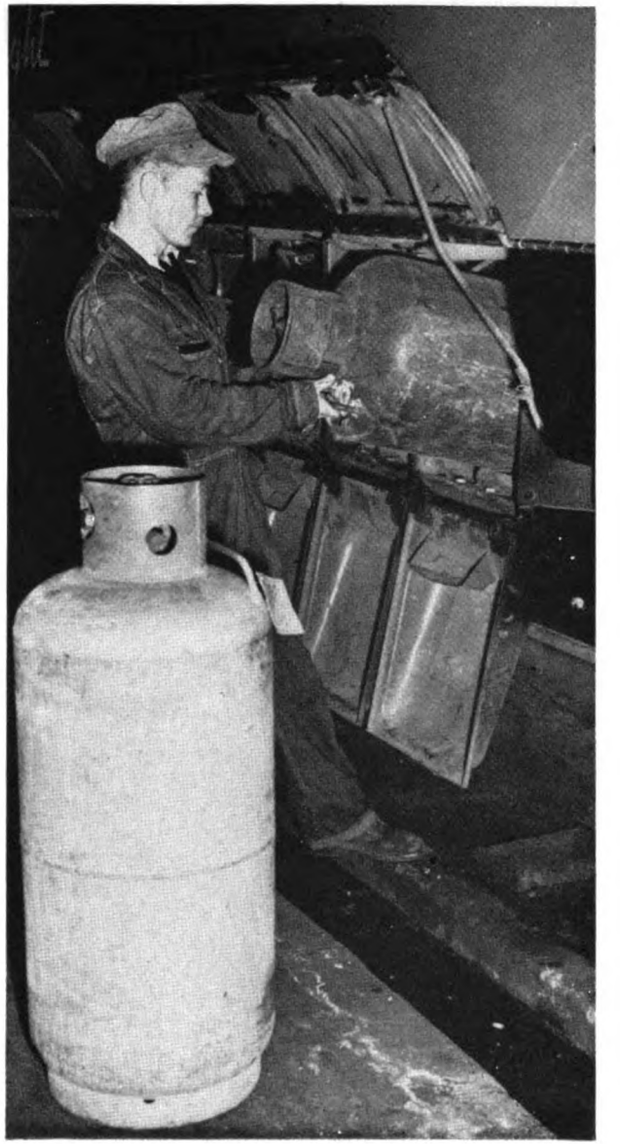
Mechanics check air-conditioning units, lights, public address system, and (right) the electric brake system

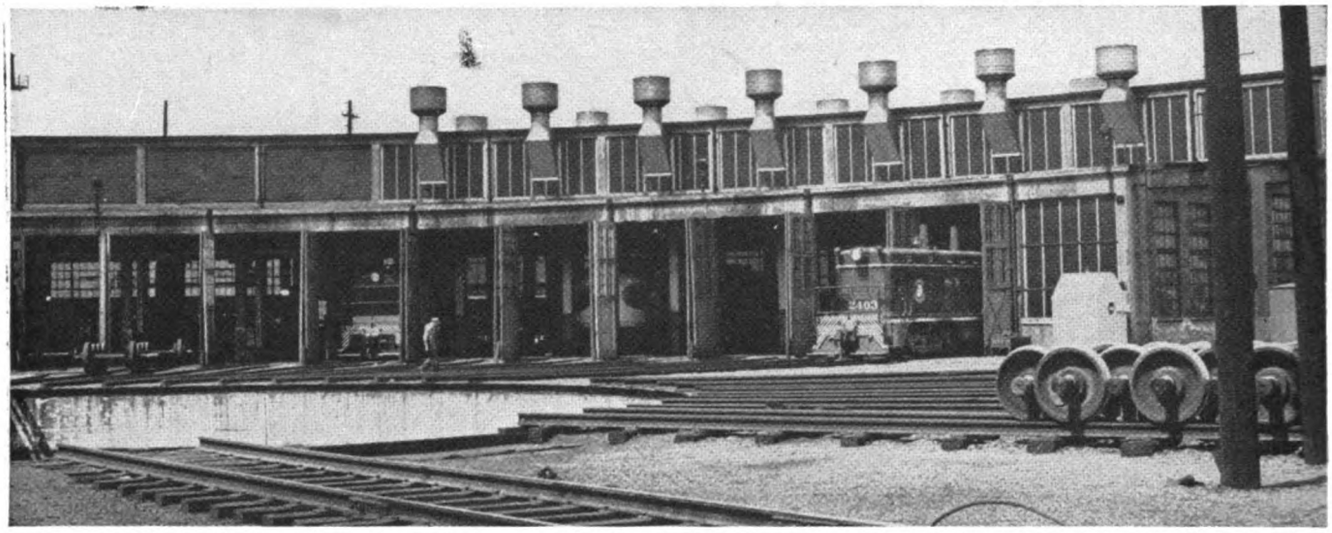




Time allowed for the cleaning, maintenance and servicing of cars and diesel power is approximately six hours, or about 750 man-hours

Replacing empty propane gas cylinder. Cars are spotted on elevated repair track equipped with drop pits for quick removal and replacement of wheels





Seven stalls in this roundhouse have been converted for progressive maintenance work on Diesel-electric locomotives

Facilities for Diesel Repairs*

The considerations involved in the layout and operation of shops for diesel maintenance are discussed with relation to the facilities required

By R. H. Herman†

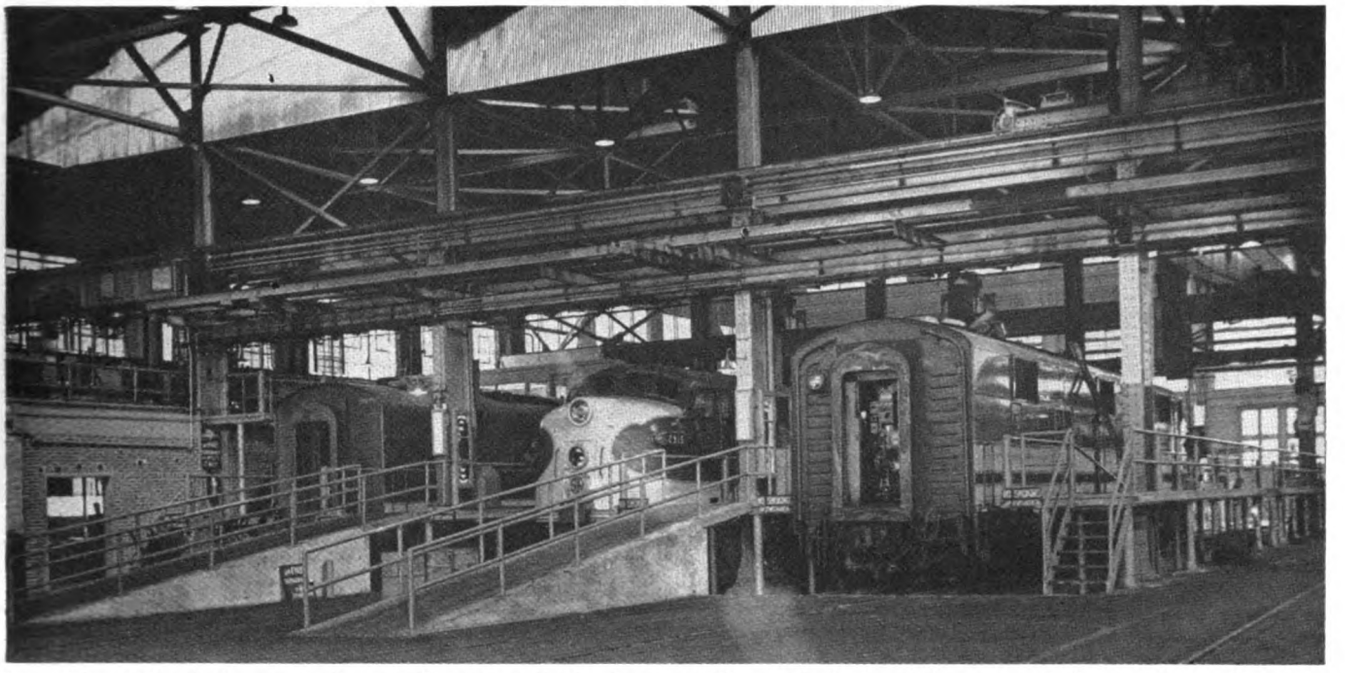


CAREFUL studies are required in the initial planning of shops or maintenance facilities for diesel-electric motive power. These studies should be made before the locomotives are ordered and should include careful consideration of all the factors outlined below to insure adequate and efficient facilities for proper repairs and maintenance of this type of equipment:

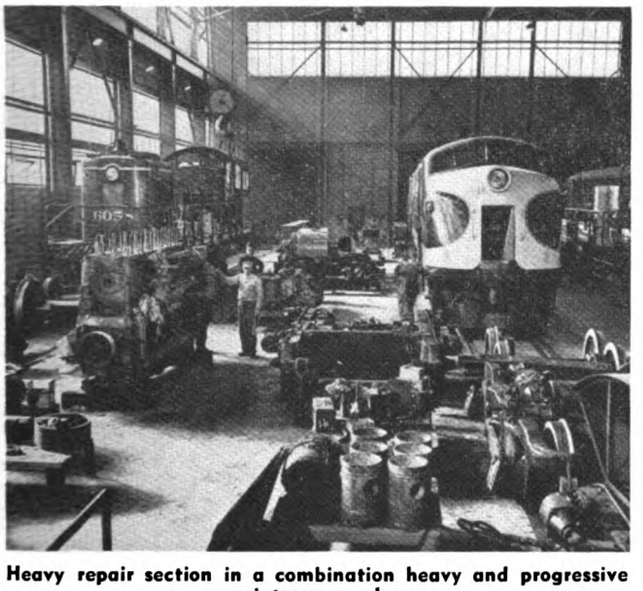
1. *Number and type of locomotive units to be maintained*—A careful analysis should be made to determine the number of locomotive units to be maintained in a given territory. This study should include allowances for future purchases and be based on the maximum number required for complete dieselization. Passenger, freight and switching locomotives require slightly different shop arrangements and the study should include an analysis of these factors. If passenger locomotives are involved it is comparatively easy to prepare a chart covering the exact time each locomotive will be in the shop or terminal for repairs. Freight locomotives are generally operated in a pool, and the period in a shop can be determined from the mileage or time between shoppings and the work to be done. Switching locomotive shop time can be determined primarily on the basis of daily or monthly inspections. A summary of this data, including allowances for future dieselization, will

* The first of several articles which constitute an abstract of material appearing in the 1951 Edition of the Locomotive Cyclopedia, Shop Section

† Engineer Shops and Equipment, Southern Railway System



Inspection pit tracks for progressive maintenance, including depressed floor and platforms, in a converted steam locomotive shop



Heavy repair section in a combination heavy and progressive maintenance shop

provide a complete picture of the number of tracks or working space required.

2. *Location*—This factor is extremely important in the planning of any diesel facility. Locomotive assignments and operations may be entirely different from that of steam locomotives because of the greater mileage between shoppings and the desirability of concentrating such work in as few shops or locations as possible. The operation of steam locomotive required a roundhouse or equivalent at each division point and at most junction points, with heavy repair or back shops at convenient locations. One diesel shop, properly located, can adequately maintain and service all the passenger and freight units on even a large system, supplemented by limited facilities at outlying points for turnaround inspections or diesel switcher maintenance.

The location will also be dependent upon the scheduling of locomotives, but if practicable it should be adjacent to existing locomotive shops or facilities to utilize present store houses, labor forces, supervision, etc., and reduce the initial investment. In this connection, it must be considered that steam facilities may be completely abandoned in the future and consequently should not have too important a bearing on the location of a new diesel shop. If too much emphasis is placed on utilization of existing facilities, full advantage may not be taken of the operating efficiencies possible with diesels.

An important factor in selecting the location for a proposed Diesel locomotive repair shop is that locomotives should be operated to that location in revenue service. The large initial investment as well as potential earning power makes it imperative that dead heading or time moving a locomotive to and from the shop be eliminated or reduced to the lowest practicable amount. Facilities should be located as close as possible to the arrival and departure tracks.

3. *Type of work to be performed*—The character of maintenance and repair work can be classified as turnaround inspections of running gear, etc., as required by the Interstate Commerce Commission, monthly inspections, routine or progressive maintenance on a mileage or time basis, and heavy repairs. An analysis should be made of the number of locomotives to receive each class of work in a given shop, and facilities should be provided to adequately and efficiently perform this work. The type of shop layout for each class of work will be discussed in detail in a succeeding article.

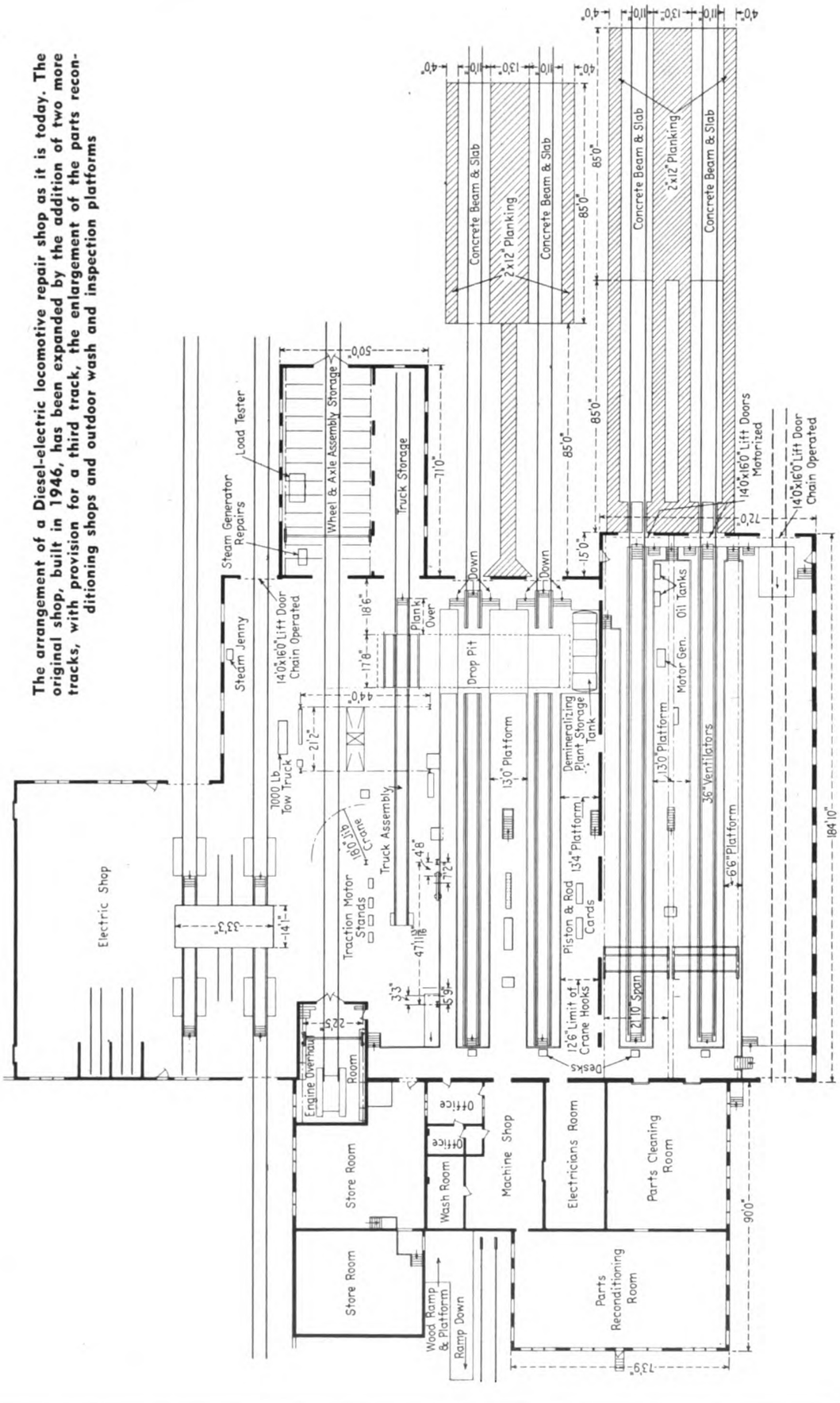
The questions below determine the facilities required.

a. What arrangements will be required for turnaround inspections?

b. Must provisions be made for changing a single pair of wheels and traction motor?

c. What arrangements will be required for progressive maintenance and running repairs?

d. Must the complete truck be removed for overhaul and repair?



The arrangement of a Diesel-electric locomotive repair shop as it is today. The original shop, built in 1946, has been expanded by the addition of two more tracks, with provision for a third track, the enlargement of the parts reconditioning shops and outdoor wash and inspection platforms

e. Will the diesel engine itself be removed and replaced and must provisions be made to overhaul it?

f. Will it be necessary to remove and replace the main generator, steam heat generator and other heavy parts?

g. Must provisions be made for heavy overhaul work. Such work may consist of heavy repairs after a wreck or derailment, major repairs to locomotive cab, frame, equipment in general or trucks, and conversion or rebuilding for increased ratings or modernization.

4. *Effect on proposed layout of increased use of diesel locomotives or complete dieselization of a system*—These factors will affect the number of tracks, amount of working space and size of facilities. Such additional space can be provided in the initial layout or provisions made in design so that it can be added when required in the future. In the early days of diesel shop planning these considerations were often overlooked or neglected with the result that many diesel shops have been outgrown. Such shops have had to be retired and replaced by more adequate facilities.

Turnaround Inspection

Provisions must be made at outlying points or terminals as well as at shop locations for turnaround inspections of diesel locomotive units. I. C. C. regulations require an inspection of the underframe, trucks, wheels, air brake equipment and safety devices at the end of each trip but not less than once each 24 hours.

Facilities for this work can be relatively simple depending upon the number of locomotives to be handled and whether any emergency repair work must be performed. If only a few locomotives are involved they can be inspected on an outside track provided with concrete platforms or walkways on each side and it is not essential that they be placed in a shop or building.

At locations where a large number of locomotives are handled and a certain amount of emergency repairs performed an inspection pit on an outside track or inside a building in colder sections of the country is very desirable for work on trucks and traction motor equipment. The inspection pit should be long enough for a complete locomotive, be well drained and provided with adequate lights in the pits and outside. Preferably the inspection pit should be enclosed or covered by a shed roof, with a small shop building to house tools, equipment and machines for emergency repair work.

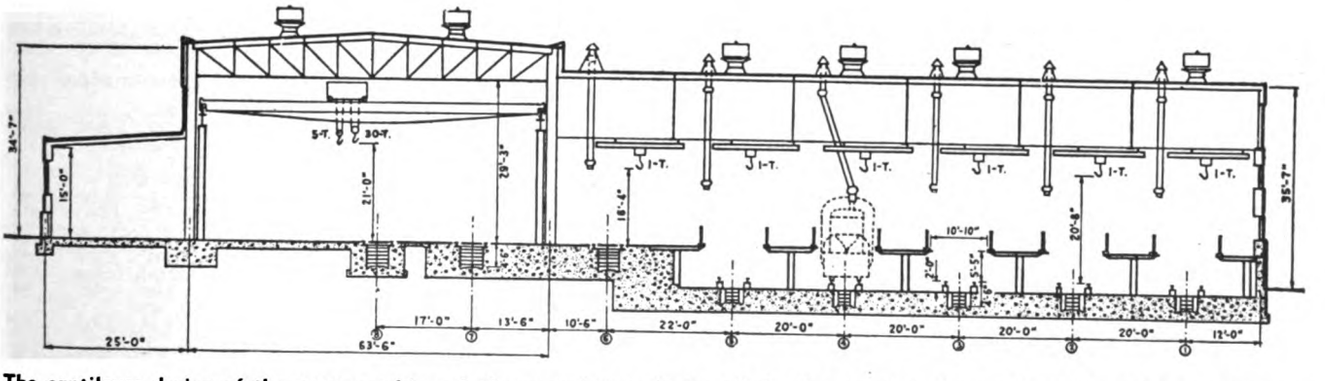
The turnaround location is normally equipped for routine servicing of the diesel locomotive with storage, pumping and disbursing facilities for Diesel fuel oil, provisions for washing underframe and cab, sand storage and disbursing arrangement, all of which may be grouped around the inspection pit or track. Lubricating oil as makeup for the diesel engine may be handled from barrels or pumped from storage tanks. Water should be available for steam heat boiler use on passenger locomotives and makeup in engine cooling system. Steam should be available to keep locomotives from freezing in extreme cold weather, and for cleaning purposes.

It is generally not necessary to provide any means for changing wheels, traction motors or other heavy parts at location devoted solely to turnaround inspection work. In the event of failure a defective traction motor or locomotive unit may be cut out and moved to the regular repair point for necessary work. At big terminals, however, where a large number of units are handled, such occurrences may be frequent and it may be desirable to provide some means for changing wheels and traction motor. Increased locomotive availability, elimination of delays to important trains and reduced labor costs will be sufficient to justify such an expenditure.

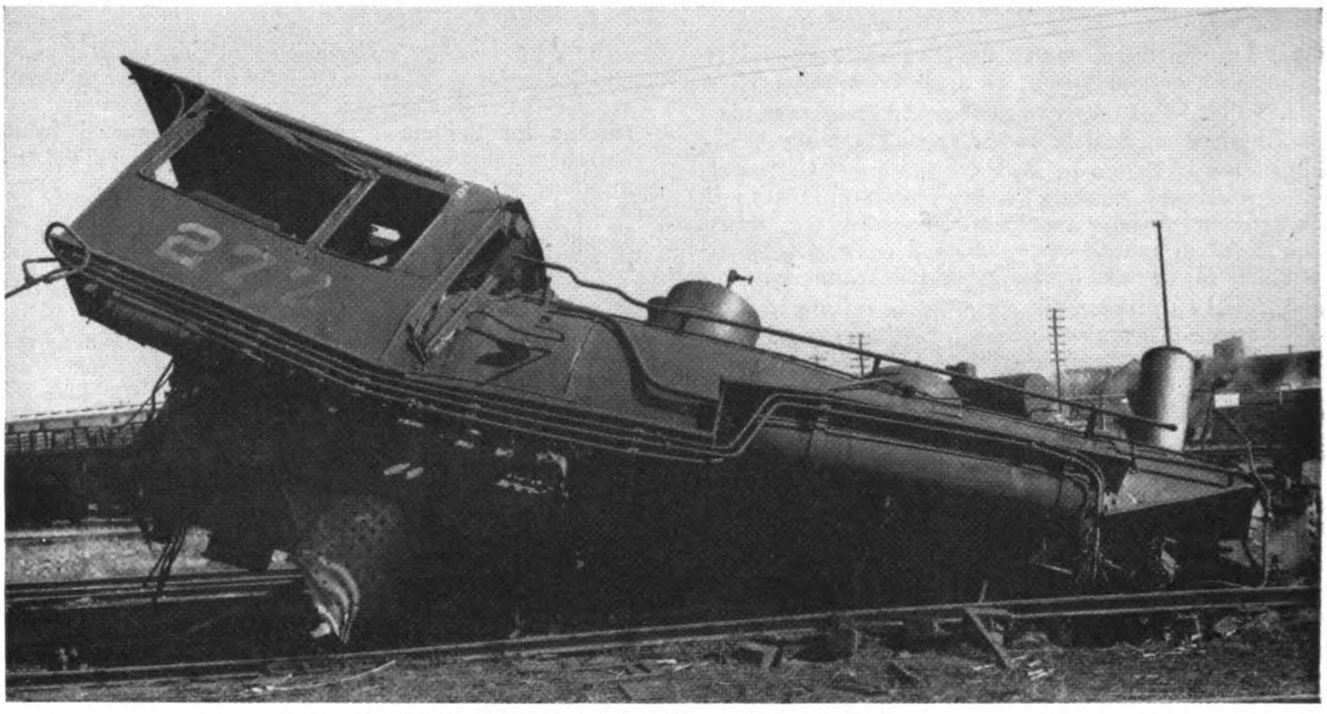
Turnaround inspection work may represent an important part of the work at a large diesel shop due to the number of times the locomotive is in the terminal area in normal operation between shoppings. At one location a diesel-electric locomotive is operated 3,500 to 4,000 miles before being taken into the shop for routine progressive maintenance but it may be in the terminal as many as eight times between shopping periods for turnaround inspection. In order to provide satisfactory space outside the shop, concrete walkways 410 feet long were installed between and outside two parallel tracks, providing space for four four-unit freight locomotives at one time. The platforms were well lighted and provided with fueling standards, water outlets and sanding facilities.

Periodic Inspection and Maintenance

Periodic maintenance or progressive maintenance covers the running repair procedure on diesel locomotive and consists of removing various engine and locomotive parts on a mileage or time basis, and replacing them with new parts from the manufacturer or with parts which were previously removed, overhauled and reconditioned. It also includes monthly and annual I. C. C. inspections. Progressive maintenance shops will vary widely in size, arrangement and type of equipment, dependent on the number and type of locomotives to be repaired and whether new facilities are provided or existing facilities converted for diesel work.



The cantilever design of the upper working platforms and the placing of the floor level in the truck-repair section on the same level as these platforms are features illustrated by this shop cross-section



The result of low water and a crown-sheet failure

Locomotive Inspection Report

Report of the I. C. C. Bureau shows 4,123 less steam locomotives and 3,027 more diesels; accidents decline from previous year

BOTH THE number of accidents and the injuries as a result thereof showed a decline during the fiscal year ended June 30, 1950, according to the annual report of the Interstate Commerce Commission Bureau of Locomotive Inspection, presented by Director Edward H. Davidson. As compared with 1949 the number of accidents were reduced from 277 to 220 and the number of persons injured from 250 to 234. The number of persons killed as a result of locomotive parts failures was 10, the same as the previous year.

The accidents resulting from failures of steam-locomotive parts alone were reduced from 228 to 169, the number killed from 10 to 7, and the number injured from 243 to 184. The number of steam locomotives for which reports were filed, however, dropped from 33,866 in 1949 to 29,743 in 1950, and the number inspected from 85,353 to 66,809.

Accidents caused by failures of parts of locomotives other than steam increased from 49 to 51. Three persons were killed in these accidents in 1950; none in 1949. The number of persons injured decreased from 67 to 50.

A table shows the various parts and appurtenances of steam locomotives and tenders, the failures of which have caused serious and fatal accidents during the past

TABLE I—INSPECTIONS AND THE CONDITIONS FOUND

STEAM LOCOMOTIVES

	Year ended June 30					
	1950	1949	1948	1947	1946	1945
Number of locomotives for which reports were filed	29,743	33,866	37,073	39,578	41,851	43,019
Number inspected	66,809	85,353	93,917	94,034	101,869	115,979
Number found defective	6,740	7,035	9,417	10,248	11,337	11,975
Percentage inspected found defective	10.1	8.2	10.0	10.9	11.1	10.3
Number ordered out of service	399	436	654	708	690	506
Number of defects found	28,504	28,642	38,855	41,250	56,541	53,367

LOCOMOTIVES OTHER THAN STEAM

	Year ended June 30					
	1950	1949	1948	1947	1946	1945
Number of locomotive units for which reports were filed	15,719	12,692	9,803	7,805	6,616	6,094
Number inspected	42,503	30,681	20,798	13,115	10,908	9,888
Number found defective	2,748	1,238	853	633	499	447
Percentage of inspected found defective	6.5	4.0	4.1	4.8	4.6	4.5
Number ordered out of service	42	20	21	19	17	16
Number of defects found	6,325	2,804	1,745	1,442	1,385	1,212

TABLE II—ACCIDENTS CAUSED BY LOCOMOTIVE PARTS FAILURES

STEAM LOCOMOTIVES, INCLUDING BOILER, OR TENDER

	Year ended June 30					
	1950	1949	1948	1947	1946	1945
Number of accidents	169	228	341	360	419	410
Percent increase or decrease from previous year	25.9	33.1	5.3	14.1	[1]2.2	1.7[1]
Number of persons killed	7	10	15	16	10	20
Percent increase or decrease from previous year	30.0	33.3	6.3	[1]60.0	50.0	20.0
Number of persons injured	184	243	361	464	439	429
Percent increase or decrease from previous year	24.3	32.7	22.2	[1]5.7	[1]2.3	7.9

[1] Increase.

STEAM LOCOMOTIVE BOILER [1]

	Year ended June 30							
	1950	1949	1948	1947	1946	1945	1915	1912
Number of accidents	59	81	104	116	156	141	424	856
Number of persons killed	4	9	14	12	10	13	13	91
Number of persons injured	70	94	108	124	165	154	467	1,005

[1] The original act applied only to the locomotive boiler.

LOCOMOTIVES OTHER THAN STEAM AND THEIR APPURTENANCES

	Year ended June 30					
	1950	1949	1948	1947	1946	1945
Number of accidents	51	49	41	40	38	29
Number of persons killed	3	....	....	2	....	1
Number of persons injured	50	67	50	41	56	40

five years. Of the 169 accidents in 1950, 46 were caused by the failure of miscellaneous parts not classified. Classified were 35 parts, failures of which caused 123 accidents. The largest single group is handholds, which caused 11 accidents. Other sizable groups are boiler explosions, reversing gears and squirt hose, each the cause of nine accidents, and footboards, the cause of eight accidents. Injectors and connections and throttle rigging were each the cause of seven accidents. The number of accidents charged to each of the other parts range from one to six and in most cases do not exceed three. Failures which were the cause of death were boiler explosions (4); couplers (1); crossheads and guides (1), and reverse gears (1). The report calls attention to this table with the suggestion that, if advantage is taken of the information contained in it and proper inspection and repairs made in accordance with the requirements of the law and rule, many accidents will be avoided. An abstract of the remainder of the report follows.

During the year, 10 per cent of the steam locomotives inspected by our inspectors were found with defects or errors in inspection that should have been corrected before the locomotives were put into use; this is an increase of 2 per cent from the results obtained in the preceding year. Three hundred and ninety-nine locomotives were ordered withheld from service by our inspectors because of the presence of defects that rendered the locomotives immediately unsafe; this is a decrease of 37 locomotives compared with the preceding year.

Explosions and Other Boiler Accidents

Nine boiler explosions occurred in the fiscal year; all were caused by overheating of the crown sheets due to low water. Four employees were killed in these accidents and 14 were injured. There was an increase of four in the number of boiler explosions and a decrease of three in the number of employees killed compared with the preceding year.

One of the explosions occurred on a locomotive in passenger-train service, three on locomotives in freight-train service; two on locomotives in charge of watchmen; and one each on locomotives in switching, mixed, and work train service. The boilers involved in the explosions were not equipped with either fusible plugs or low-water alarms.

Absence of a safe water level was known to employees on two of the locomotives prior to the explosion. On one of these the low water level resulted from undetected loss of water through an inadvertently opened blow-off cock which discharged through a muffler located under the locomotive deck. Action to restore water to the boiler had been initiated, but the explosion occurred before a sufficient quantity of water had been fed to the boiler. Subsequently, blow-off mechanisms on all locomotives owned by the railroad on which the explosion occurred were examined, redesigned, and reconstructed where necessary to prevent repetition of conditions responsible for the explosion.

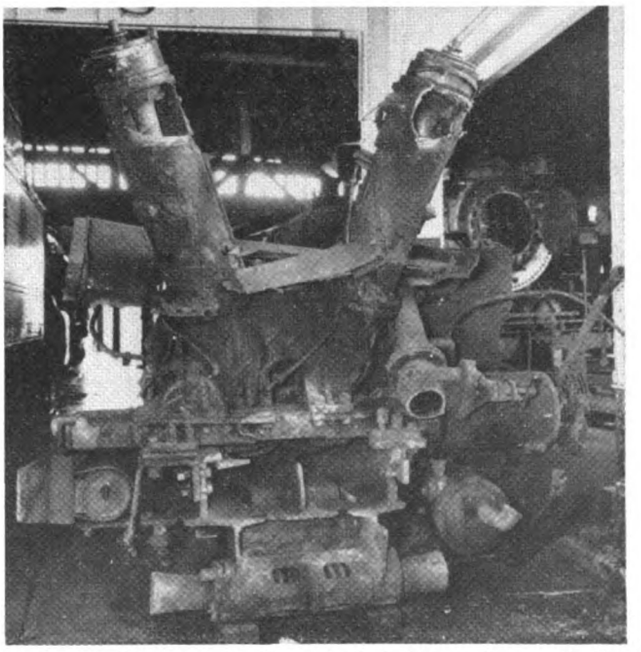
Fifty boiler and appurtenance accidents other than explosions resulted in injuries to 56 employees. This is a decrease of 26 accidents and a decrease of 24 injuries compared with the preceding year.

Flue Removal Extensions

Four hundred and seventy applications were filed for extension of time for removal of flues, as provided in rule 10. Our investigations disclosed that in 33 of these cases the condition of the locomotives or other circumstances were such that extensions could not properly be granted. Nine were in such condition that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Twenty-four extensions were granted after defects disclosed by our investigations were required to be repaired. Eighteen applications were cancelled for various reasons. Three hundred and eighty-six applications were granted for the full period requested.

Locomotives Other Than Steam

Fifty-one accidents, resulting in 3 deaths and injuries to 50 persons occurred in connection with locomotive



A cast-steel frame tail piece which failed as the result of a progressive crack

TABLE III—ACCIDENTS AND CASUALTIES RESULTING FROM FAILURES OF LOCOMOTIVE PARTS

STEAM LOCOMOTIVES AND TENDERS, AND THEIR APPURTENANCES

Part or appurtenance which caused accident	Year ended June 30														
	1950			1949			1948			1947			1946		
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured
Air reservoirs							1		2	1		1	1		1
Aprons	2		2	3		3	5		5	4		4	2		2
Arch tubes	1		1												
Ashpan blowers				1		1							1		1
Axles							3		3	1	2	1	1		1
Blow-off cocks	2		2	5	1	4	5		5	8		8	15		16
Boiler checks	3		3	4		5	7	1	6	7		7	8		8
Boiler explosions:															
A. Shell explosions															
B. Crown sheet; low water; no contributary causes found	8	4	12	4	6	13	10	12	8	11	7	16	15	7	20
C. Crown sheet; low water; confound	1		2	1	1	1	3		7	2	4	3	3	3	2
D. Miscellaneous firebox failures										2		4	1		1
Brakes and brake rigging	2		2	3		4	11		24	8		12	10		12
Couplers	4	1	4	3		4	4		4	6		6	5		5
Crank pins, collars, etc	1		1				2		2	3		3	5		5
Crossheads and guides	1	1	2	1		1	1		1	2		2	3		5
Cylinder cocks and rigging							3		3	3		3	1		1
Cylinder heads and steam chests							1		1	2		2	1		1
Dome caps															
Draft appliances				3		3							2		2
Draw gear	1		1							1		1	1		1
Fire doors, levers, etc	2		2	3		3	10		10	2		2	2		2
Flues	6		9	3		3	8		9	4		4	10		12
Flue pockets															
Footboards	8		8	10		10	15		15	15		15	12		12
Gage cocks				1		1									
Grease cups	1		1							1		1	1		1
Grate shakers	6		6	11		11	15		15	20		20	25		25
Handholds	11		11	13	1	12	12		12	18		18	20		20
Headlights and brackets	1		1	1		1	3		3	2		2	2		2
Injectors and connections (not including injector steam pipes)	7		7	12		12	10		10	14		14	14		14
Injector steam pipes							4		5	4	1	4	2		2
Lubricators and connections	2		2	4		4	2		2	4		4	5		5
Lubricator glasses	1		1	1		1							2		2
Patch bolts															
Pistons and piston rods							2		2	1		1			
Plugs, arch tube and washout	1		1				3		3	1		1	1		1
Plugs in firebox sheets													1		1
Reversing gear	9	1	8	6		6	12		12	13		13	11		11
Rivets				1		1									
Rods, main and side	1		2	2		2	5		7	3	1	2	7		7
Safety valves															
Sanders	4		4	4		4	4		4	5		5	4		4
Side bearings				1		1									
Springs and spring rigging	3		3	1		1	4		4	3		77	6		7
Squirt hose	9		9	14		14	5		5	19		19	14		15
Staybolts	1		1				4		4	2		2	1		1
Steam piping and blowers	3		6	4	1	3	13	1	13	4		4	15		15
Steam valves	3		3	3		3	6		6	8		8	13		13
Studs	1		1	1		1				2		2	1		1
Superheater tubes	3		3	3		6	2		3	2		2	2		2
Throttle glands	2		2	3		4	1		1				1		1
Throttle leaking	2		2	1		1	1		1	2		2	1		1
Throttle rigging	7		7	11		11	10		10	16		17	15		16
Trucks, leading, trailing, or tender				3		3				2		20	10		12
Valve gear, eccentrics, and rods				1		1	3		3	4		4	7		7
Water glasses	3		3	5		5	4		4	8		8	12		13
Water-glass fittings				3		4	3		3	3		3	2		2
Wheels							3	1	2				1		1
Miscellaneous	46		49	74		75	121		122	117	1	117	124		127
Total	169	7	184	228	10	243	341	15	361	360	16	464	419	10	439

TABLE IV—NUMBER OF STEAM LOCOMOTIVES REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED OUT OF SERVICE—Continued

Parts defective, inoperative or missing, or in violation of the rules	Year ended June 30					
	1950	1949	1948	1947	1946	1945
42. Reversing gear	404	405	649	528	482	439
43. Rods, main and side, crank pins, and collars	1,213	1,408	1,998	2,136	2,581	2,569
44. Safety valves	34	45	45	70	72	84
45. Sanders	641	608	597	569	784	658
46. Springs and spring rigging	2,848	3,177	4,124	4,622	5,195	4,734
47. Squirt hose	74	63	93	79	120	98
48. Stay bolts	229	227	292	318	360	351
49. Stay bolts, broken	193	196	258	283	268	308
50. Steam pipes	302	256	435	356	551	416
51. Steam valves	131	133	150	146	203	157
52. Steps	680	652	767	778	914	681
53. Tanks and tank valves	1,205	1,228	1,757	1,558	1,570	1,215
54. Telltale holes	28	33	60	69	60	78
55. Throttle and throttle rigging	664	709	923	1,026	979	948
56. Trucks, engine and trailing	580	545	812	1,005	1,261	1,151
57. Trucks, tender	540	471	652	795	1,101	974
58. Valve motion	486	484	676	778	1,080	991
59. Washout plugs	289	268	384	441	740	820
60. Stokers	261	216	270	208	....	....
61. Water glasses, fittings, and shields	907	920	1,039	1,318	1,190	1,328
62. Wheels	394	455	779	583	840	899
63. Miscellaneous—signal appliances, badge plates, brakes (hand)	652	626	707	870	1,337	1,213
Total number of defects	28,504	28,642	38,855	41,250	56,541	53,367
Locomotives reported	29,743	33,866	37,073	39,578	41,851	43,019
Locomotives inspected	66,809	85,353	93,917	94,034	101,859	115,979
Locomotives defective	6,740	7,035	9,417	10,248	11,337	11,975
Percentage of inspected found defective	10.1	8.2	10.0	10.9	11.1	10.3
Locomotives ordered out of service	399	436	654	708	690	506

TABLE V—NUMBER OF LOCOMOTIVE UNITS OTHER THAN STEAM REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED FROM SERVICE

Parts defective, inoperative or missing, or in violation of the rules	Year ended June					
	1950	1949	1948	1947	1946	1945
1. Air compressors	99	26	32	9	15	14
2. Axles, truck and driving	2	1	3	2	....	....
4. Batteries	20	13	8	1	2	....
5. Boilers	46	9	30	5	11	8
6. Brake equipment	673	299	204	178	102	114
8. Cabs and cab windows	377	159	90	97	46	59
9. Cab cards	75	46	37	29	24	25
10. Cab floors, aprons, and deck plates	726	234	134	130	72	60
11. Clutches	1	2	....	....	2	2
12. Controllers, relays, circuit breakers, magnet valves, and switch groups	61	35	24	14	16	18
13. Coupling and uncoupling devices	32	15	12	13	6	6
14. Current collecting apparatus	18	20	11	3	9	10
16. Draft gear	91	66	36	30	18	14
17. Draw gear	27	13	8	4	3	8
18. Driving boxes, shoes, and wedges	51	33	16	38	44	29
20. Frames or frame braces	9	5	2	7	10	12
22. Fuel system	483	191	136	66	57	45
23. Gages or fittings, air	29	11	11	10	7	7
24. Gages or fittings, steam	14	2	2	5	....	....
25. Gears and pinions	15	6	9	1	....	....
26. Handholds	70	53	32	22	18	13
28. Inspections and tests not made as required	116	90	59	78	357	297
29. Insulation and safety devices	48	36	10	11	12	17
30. Internal-combustion engine defects, parts and appurtenances	1,456	602	241	254	145	133
32. Jack shafts	8	11	5	3	4	6
33. Jumpers and cable connectors	86	8	7	1	8	9
35. Lateral motion, wheels	2	7	18	7	18	20
36. Lights, cab and classification	7	5	5	1	2	....
37. Lights, headlight	9	3	3	2	....	1
39. Meters, volt and ampere	7	....	3	3	4	2
40. Motors and generators	106	46	26	16	15	12
42. Pilots and pilot beams	29	16	23	15	8	1
43. Plugs and studs	....	....	....	....	....	1

TABLE III—ACCIDENTS AND CASUALTIES RESULTING FROM FAILURE OF LOCOMOTIVE PARTS—Continued

LOCOMOTIVES OTHER THAN STEAM AND THEIR APPURTENANCES

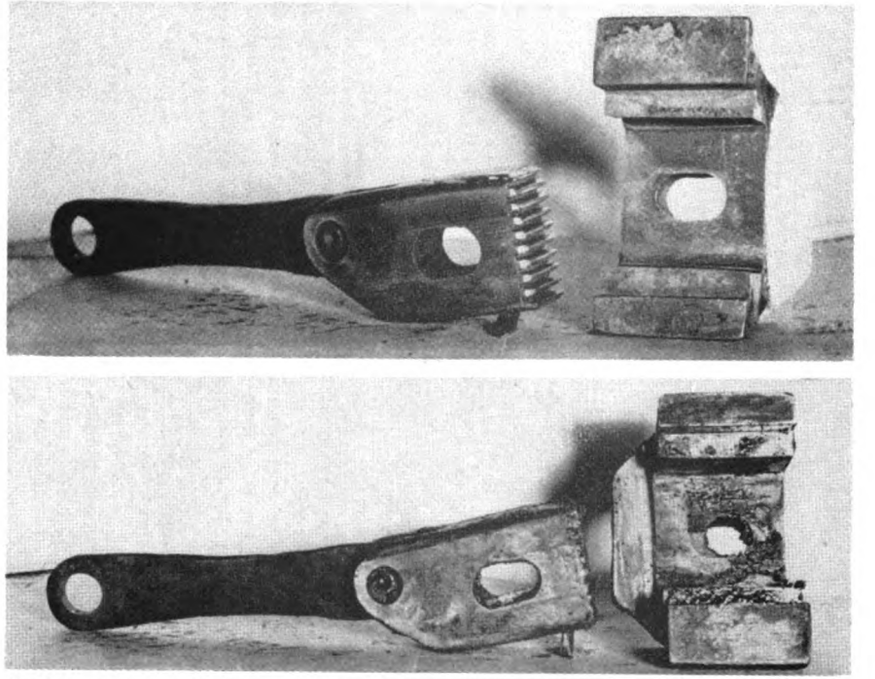
Part or appurtenance which caused accident	Year ended June 30														
	1950			1949			1948			1947			1946		
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured
Brakes and brake rigging	4	...	4	4	...	5	3	...	6	2	...	2	2	...	3
Carburetors	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Couplers	1	...	1	1	...	1	...	...	...	2	...	2	...	...	...
Crank pins and connecting rods	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fires due to overflowing or leakage of fuel, crankcase explosions, back firing, etc.	4	...	4	8	...	9	3	...	3	7	...	8	4	...	5
Generating and starting devices	1	...	1	1	...	1	1	...	1	...	...	...	...	...	...
Insulation	...	...	...	1	...	1	...	...	...	4	1	5	1	...	1
Pantographs and trolleys	1	1	...	1	...	1	...	...	...	1	1	...	2	...	2
Short circuits	2	...	2	6	...	6	7	...	7	2	...	2	2	...	2
Miscellaneous	38	2	38	27	...	43	27	...	33	22	...	22	27	...	43
Total	51	3	50	49	...	67	41	...	50	40	2	41	38	...	56

TABLE IV—NUMBER OF STEAM LOCOMOTIVES REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED OUT OF SERVICE

Parts defective, inoperative or missing, or in violation of the rules	Year ended June					
	1950	1949	1948	1947	1946	1945
1. Air compressors	719	693	1,007	944	1,044	1,750
2. Arch tubes	9	11	15	19	27	1
3. Ashpans and mechanism	59	52	72	87	93	81
4. Axles	1	4	8	6	7	11
5. Blow-off cocks	220	220	274	308	388	361
6. Boiler checks	386	337	424	428	526	511
7. Boiler shell	211	208	298	342	462	416
8. Brake equipment	1,845	1,806	2,617	2,512	2,992	2,755
9. Cabs, cab windows, and curtains	862	781	1,049	1,347	1,501	1,057
10. Cab aprons and decks	364	355	414	428	469	426
11. Cab cards	97	95	109	91	120	91
12. Coupling and uncoupling devices	41	42	55	58	46	57
13. Crossheads, guides, pistons, and piston rods	1,100	1,147	1,611	1,683	1,941	2,079
14. Crown bolts	53	46	78	98	88	90
15. Cylinders, saddles, and steam chests	1,160	1,155	1,617	2,004	2,217	1,801
16. Cylinder cocks and rigging	376	356	494	650	679	454
17. Domes and dome caps	90	82	142	130	164	186
18. Draft gear	368	370	461	449	536	487
19. Draw gear	280	300	413	453	462	447
20. Driving boxes, shoes, wedges, pedestals, and braces	1,037	1,070	1,582	1,580	1,922	1,803
21. Firebox sheets	181	191	302	257	333	319
22. Flues	152	156	201	197	253	260
23. Frames, tail pieces, and braces, locomotive	451	451	576	820	1,003	852
24. Frames, tender	34	39	72	63	88	97
25. Gages and gage fittings, air	116	118	185	135	185	151
26. Gages and gage fittings, steam	272	268	354	358	370	353
27. Gage cocks	386	375	474	404	495	449
28. Grate shakers and fire doors	326	286	455	444	555	558
29. Handholds	439	421	513	469	540	527
30. Injectors, inoperative	45	39	66	39	50	41
31. Injectors and connections	1,767	1,795	2,329	2,369	2,750	2,553
32. Inspections and tests not made as required	122	104	148	350	8,885	9,067
33. Lateral motion	389	507	821	791	862	977
34. Lights, cab and classification	60	58	132	155	161	167
35. Lights, headlight	131	118	183	143	168	222
36. Lubricators and shields	157	157	236	228	351	306
37. Mud rings	145	147	186	217	238	257
38. Packing nuts	558	474	456	575	691	654
39. Packing, piston rod and valve stem	510	511	658	691	776	845
40. Pilots and pilot beams	126	73	132	156	153	171
41. Plugs and studs	104	99	169	236	262	245

TABLE V—NUMBER OF LOCOMOTIVES, OTHER THAN STEAM, REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED OUT OF SERVICE—Continued

Parts defective, inoperative or missing, or in violation of the rules	Year ended June					
	1950	1949	1948	1947	1946	1945
44. Quills	10	9	16	18	52	29
46. Rods, main, side, and drive shafts	6	1	5	6	11	3
48. Sanders	356	151	106	82	57	50
49. Springs and spring rigging, driving and truck	103	43	44	63	42	38
51. Stay bolts, broken or defective	1	....	....	....	....	....
53. Steam pipes	32	17	10	4	1	6
54. Steps, footboards, etc.	284	213	116	68	29	28
55. Switches, hand-operated, and fuses	9	1	3	1	....	7
56. Transformers, resistors, and rheostats	9	2	6	2	3	....
57. Trucks	182	84	65	45	52	42
59. Water tanks	20	2	1	2	1	2
60. Water glasses, fittings, and shields	27	2	18	....	15	2
61. Warning signal appliances	21	9	7	8	2	....
62. Wheels	95	98	72	48	54	46
63. Miscellaneous	377	109	39	40	31	16
Total number of defects	6,325	2,804	1,745	1,442	1,385	1,212
Locomotive units reported	15,719	12,692	9,803	7,805	6,616	6,094
Locomotive units inspected	42,503	30,684	20,798	13,115	10,908	9,888
Locomotive units defective	2,748	1,238	853	633	499	447
Percentage of inspected found defective	6.5	4.0	4.1	4.8	4.6	4.5
Locomotive units ordered out of service	42	20	21	19	17	16



Fouled condition of a power reverse gear latch block which stuck in raised position and failed to engage the quadrant which permitted the reverse gear to make undesired movement to position for forward motion while the locomotive was backing a cut of five cars. The top illustration shows the latch mechanism after it was cleaned and placed in proper operating condition

units propelled by power other than steam. This represents an increase of 2 in the number of accidents, occurrence of 3 fatalities, and a decrease of 17 in the number of injured compared with the preceding year.

During the year 6.5 per cent of the locomotive units inspected by our inspectors were found with defects or errors in inspection that should have been corrected before the units were put into use; this represents an increase of 2.5 per cent compared with the results obtained in the preceding year. Forty-two locomotive units were ordered withheld from service by our inspectors because of the presence of defects that rendered the units immediately unsafe; this represents an increase of 22 units compared with the preceding year.

Specification Cards and Alteration Reports

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 114 specification cards and 2,748 alteration reports were filed, checked, and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

Under Rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 3,287 specifications and 1,165 alteration reports were filed for locomotive units and 564 specifications and 257 alteration reports were filed for boilers mounted on locomotive units other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

Buggy Stores-Filters Drained Diesel Lube Oil

The Pegram shops of the Southern at Atlanta, Ga., is using a lubricating oil buggy which stores and filters diesel lubricating oil. It is used when repairs are needed on engines in which the lubricating oil is in satisfactory condition for additional mileage. The oil from such engines is transferred from the engine to the buggy by a pump mounted on the buggy. While the engine is being repaired the transfer pump circulates the oil in the buggy through a set of filters. When the engine repairs are completed, the same transfer pump returns the cleaned oil to the engine.

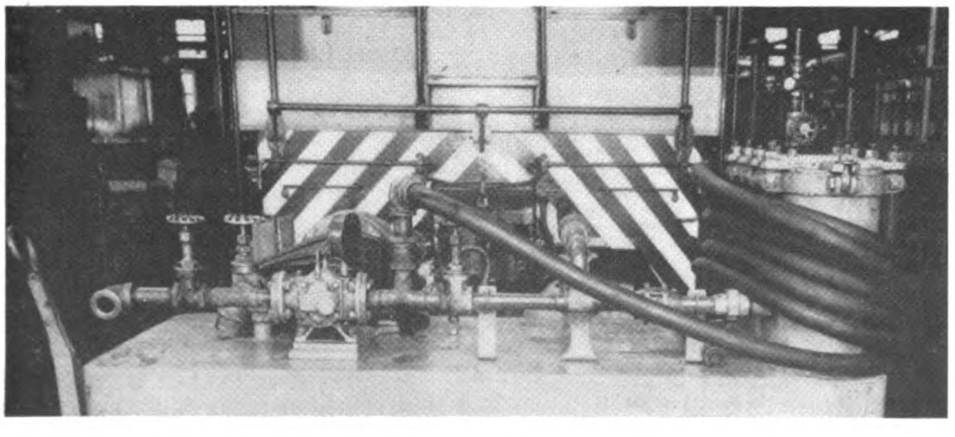
The buggy is mounted on four rubber-tired wheels 5 in. by 16 in. and has a capacity of 165 gal. It is normally moved to where it is needed by a shop truck but can be moved by hand if necessary. A gear pump driven by a 3-hp. motor is used to transfer the oil to and from the tank, and to circulate the oil through the filters. The inlet of the pump is fitted with a 50-ft. length of neoprene hose for draining or filling the engines. Fittings on the buggy are 1½-in. pipe. The piping and valve arrangement is such that oil can be pumped into the tank, then by closing the intake valve and opening the valve to the filter compartment, the oil can be filtered within the cart. The engine is refilled by reversing the gear pump.

The tank on the buggy is 38 in. by 80 in. by 17 in., and is constructed of ⅜-in. plate. The filter compartment is 10 in. by 36 in. by 18 in. high and holds five Michiana circular filters. This compartment is fitted with a vent on top to aid in draining the oil when the filters are to be changed, and to exhaust the displaced air during filling. The filters are protected by a 30-lb. by-pass valve and by sight glasses. A sump in the shape of a segment of a circle with a 6-in. radius extends across the entire width of the tank. The pump takes its suction from the sump, and can thereby drain all of the oil within the tank. The sump is welded to the bottom of the tank, and is 2 in. deep and 5 in. wide.

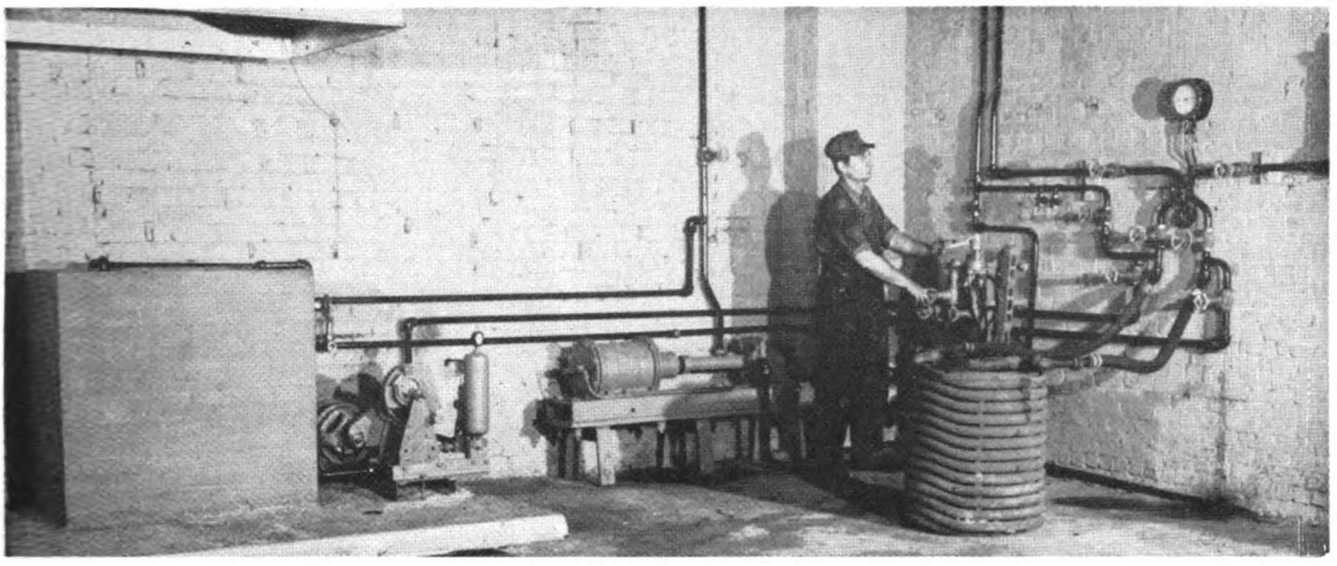
Single Layout Cleans and Tests Coils

The cleaning and testing of Vapor steam generators is performed at a single location with a single set-up at the Pegram shops of the Southern at Atlanta, Ga. City water and water pressure are used for the flow test, delivery being made through 1-in. piping mounted on one wall of the shop. An acid bath pump is located adjacent to this city water piping, and connected to it through valves, so that only one set-up is required for both testing and cleaning the coil. Should a coil fail to pass the first flow test after cleaning, it does not have to be removed for re-hammering, recleaning and retesting.

Each of three coils in the generator set is tested separately. The test is conducted by throttling the outlet to attain a flow of 10 g.p.m. The pressure drop is measured by a gage, one line of which is connected to the water inlet and a second to the water outlet. With this arrangement the pressure drop through a new, clean, unrestricted coil is about 22 p.s.i. After a term of service



Buggy for storing and filtering diesel lube oil while repairs are being made to the engine

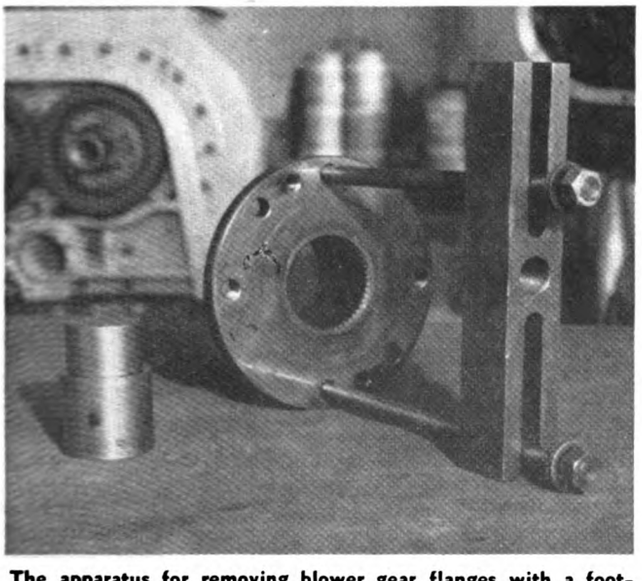


Compact arrangement for cleaning and testing steam generator coils

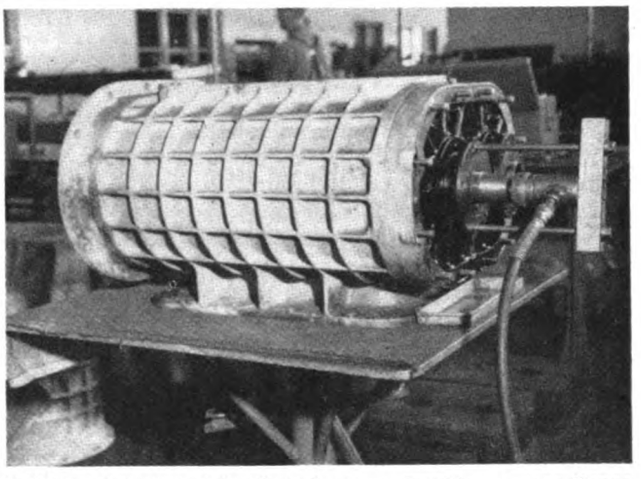
this increases to from 25 to 35 lb. After the initial test the coil is scaled and cleaned with Pennsalt 90, and the pressure drop test repeated. If this test shows a drop greater than 26 p.s.i., the coils are recleaned with the solution and hammered. If after the second cleaning the pressure drop still exceeds 26 p.s.i., the coil is discarded. Coils which pass the pressure drop test are given a hydrostatic test of 1,200 p.s.i. generated by a second pump in the immediate vicinity.

Simple Puller for Blower Gear Flanges

The combination gear flange and lobe bearing on diesel engine blowers is removed safely and quickly by means of the pulling arrangement illustrated. The device is used in conjunction with a hand-operated hydraulic pump, and it consists of a pair of studs that screw into the gear flange on one end and are secured to a pulling piece on the other end with nuts and washers.



The apparatus for removing blower gear flanges with a foot-operated hydraulic pump

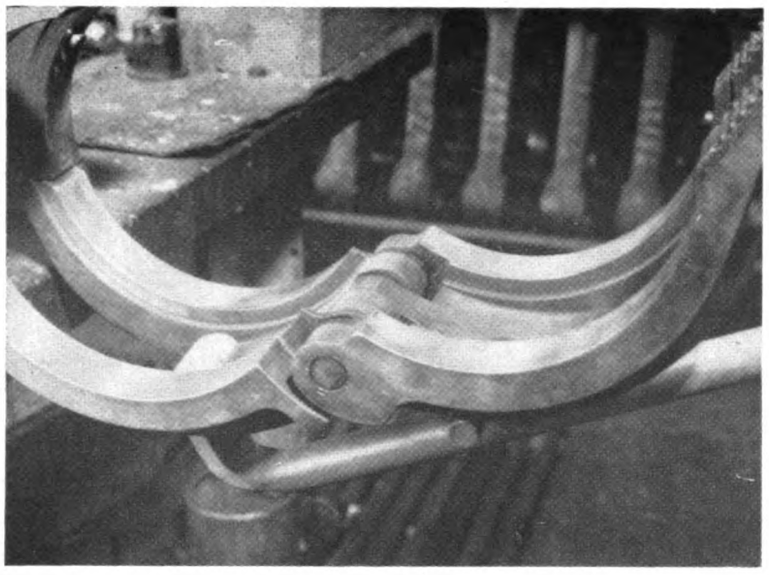


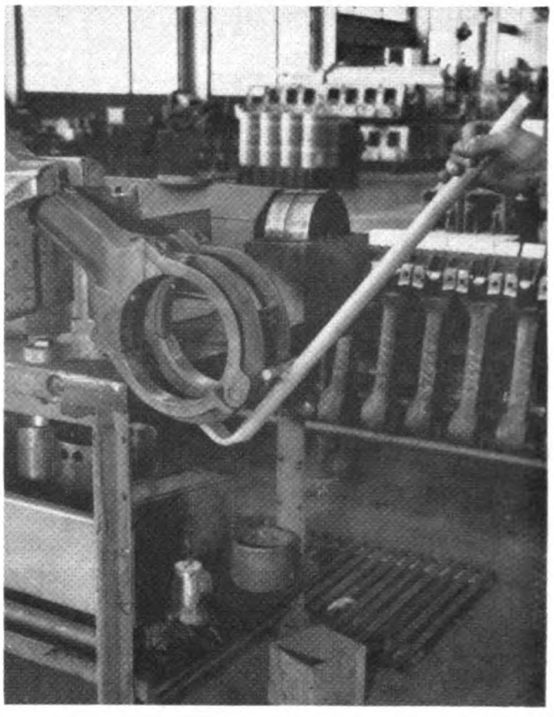
Pulling arrangement in place for removing blower gear flange

After the studs are screwed into the gear flange and the backing-up piece placed at the opposite end of the studs, the hydraulic pump is placed with the blind end against the backing up piece and the ram end applying the force to remove the flange through a filler piece.

Lever Simplifies Basket Application

An easily made lever is used at a western railroad shop in lining up diesel engine baskets for the application of the cap screws when the rod is in place in the engine. The lever has a hook at the bottom end which contacts the web of the basket opposite to the one being forced into place. A $\frac{5}{8}$-in. rod, 4 in. long, is welded on the lever a short distance up from the bottom to give proper contact for forcing the basket into place.





How the lever (left) is used to align the second side of a basket when the rod is in place on the engine. The bottom of the lever (above) showing how the hook is placed on the bottom web of one basket while the short rod contacts the second basket to force the latter into place

The rod is used for putting the last side of the basket in place only. The first side is secured in place by hand, there being no resistance to lining this side up. After the first side has been applied and its cap screws tightened, the lever forces the second side in place for lining up the cap screw holes and holds the second side in place with the holes aligned for applying the cap screws.

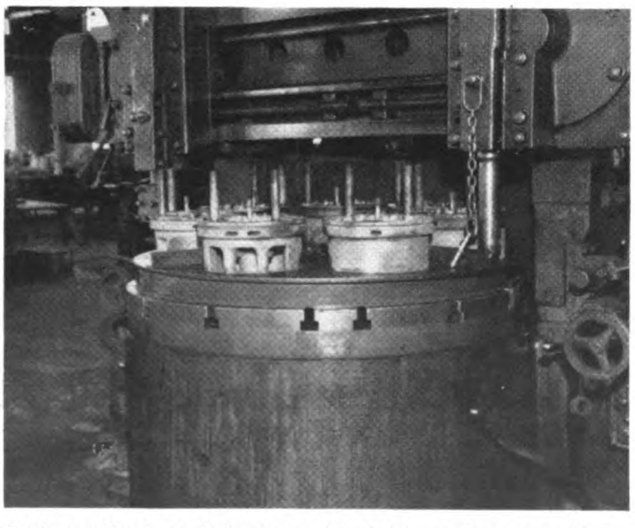
Facing Bottoms of Cylinder Heads

The bottoms of cylinder heads are lapped seven at a time at the West Burlington, Iowa, shops of the Chicago, Burlington & Quincy. A boring mill equipped with two circular plates equal in diameter to the table is used for the job, which takes about 20 minutes of lapping time. The lapping is done with the use of oil and powdered emery.

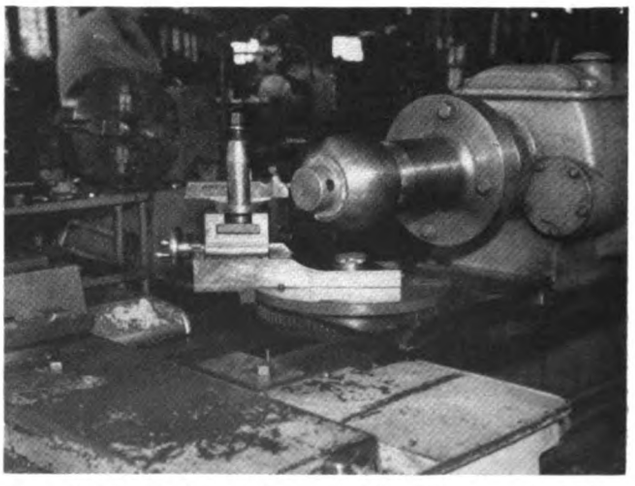
The bottom plate is bolted to the table and is lined with approximately ¾ in. of babbitt which is faced off in position. It also has an eccentric boss at the center of the table that extends through the top plate. The top plate is held stationary by a bar that is placed in the ram of the boring mill and, as the boring mill table revolves, the heads oscillate approximately 1½ in. and at the same time turn about a larger radius; friction created on the outside of the table rotates the heads.

This lapping operation is performed on all heads, whether they have been machined or not, in order to create a better bearing and eliminate water leaks.

* * *



Boring mill adapted for facing the bottoms of seven cylinder heads simultaneously in 20 min.



Engine lathe attachment for turning diesel locomotive pulling-bar steel balls. The rough balls are mounted on a mandrel for the turning operation after they have been roughed out on a turret lathe. The attachment for generaing the spherical surface is driven by the machine feed. The mandrel on which the ball is mounted is in two parts. One part bolts to the machine head stock and the second is pressed into the steel ball.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

Miscellaneous Equipment

141-Q.—What is the function of the load meter? A—It is used by the engineer as a guide for the operation of the throttle during motoring, and the selector handle in the braking range if dynamic braking is furnished.

142-Q.—What is gained by careful observance of this meter? A.—The engineer may get the maximum loading from the locomotive and guard against abusive overloading of the traction motors.

143-Q.—Which locomotives are equipped with the load meter? A.—Each *A* unit and road switcher locomotive is so equipped.

144-Q.—How many types of load meters are in use? A.—Two types of meters are in use. One is designed with the outer scale divided into three colored zones, the other is divided into two colored zones with the last zone marked off in minutes.

145-Q.—Describe the inner scale. A.—The inner or braking scale is divided into zones, white: 0 to 800 amperes and red: 800 to 1500 amperes.

146-Q.—With reference to one type, what do the figures denote? A.—A set of white figures outside the outer scale indicates the amperes in hundreds. A set of yellow figures in between the two scales indicates the time in minutes.

147-Q.—What is the purpose of the outer scale? A.—The outer scale is known as the *motoring scale.*

148-Q.—Describe the motoring scale. A.—This scale is green from 0 to 1.085 amperes, which is the continuous rating of the traction motors. In this zone the operation is unlimited. From 1,085 to 1,500 amperes the scale is yellow, indicating limited operation. The yellow figures beneath this part of the scale indicate the time in minutes the loads may be maintained.

149-Q.—Is the operating time in this zone accumulative? A.—No. When the locomotive has been operated at any of the overloads for the full time shown, or a combination of the overloads (for example, part time at the 10 min. rating and part time at the 20 min. rating) the load must be reduced into the white zone, 1000 amperes or less for 20 minutes.

150-Q.—What time must elapse before an overload is repeated? A.—One hour.

151-Q.—What can be determined by this guide? A.—By this guide the engineer can determine quickly when an overload condition arises. It will indicate whether he can reach the top of the grade or into the next siding within the overload time limit, or if he should stop immediately and reduce tonnage, double the hill, or obtain the assistance of a helper locomotive.

152-Q.—What is the purpose of the inner scale? A.—The inner or braking scale is used as a guide for the operation of the selector handle when using dynamic braking.

153-Q.—What kind of an operation is permitted in the white zone? A.—Continuous operation may be had for any pointer position within the white portion of (except as described in another section under Dynamic Braking Limit).

154-Q.—What is the meaning of the red portion of the scale? A.—Any position of the pointer in the red portion of the scale indicates an overload which must be reduced immediately to prevent possible damage to the braking grid assembly.

155-Q.—On the other type of load meter with the three colored zones in the outer scale, what does the red zone indicate? A.—The red zone at the high current end of the scale represents a heavy overload.

156-Q.—When is operation in this zone normally used? A.—For starting and accelerating the train.

157-Q.—How many minutes would be required in this zone for such operations? A.—A train of the proper tonnage should not require more than 4 minutes operation in this zone.

Schedule 24 RL Air Brakes

Overspeed Protection Feature—H-24-C Relayair Valve Unit (*continued*)

1064-Q.—What is the immediate result of air flowing into the overspeed actuating pipe 1? A.—The overspeed whistle immediately blows, indicating that an overspeed application is initiated.

1065-Q.—What additional flow of air takes place from the overspeed actuating pipe 1? A.—Air also flows through the choke in the check valve to the overspeed volume reservoir and chamber *E* of the overspeed application valve.

1066-Q.—What takes place if the train speed is not reduced? A.—If the train speed is not reduced below the overspeed setting to re-energize the FA-4 magnet valve in approximately 6 sec., air from the magnet valve flowing through the check valve builds up in the overspeed volume reservoir and in chamber *E* of the overspeed application valve.

1067-Q.—What movement results from build up of air in chamber E? A.—Diaphragm *10* and diaphragm follower *5* are moved downward to seat valve *17* and unseat valve *15.*

1068-Q.—Describe the flow of air further? A.—Air from chamber *B* on top of brake valve application piston *112* is quickly vented through passage *10,* pipe *10,* passages *17, 7* of the overspeed application valve, past unseated valve *15* to chamber *F* and out exhaust passage *6* to atmosphere.

1069-Q.—What prevents build up of air from chamber A under the service application piston 112 to chamber B

above the piston? A.—Choke K. in the service application piston prevents this build up as long as exhaust valve *15* in the overspeed application valve is unseated.

1070-Q.—What results from the escape of air from chamber B faster than it can be supplied? A.—The service application piston moves upward to "*application*" position.

1071-Q.—How does the emergency application portion function (if used)? A.—If the speed is not reduced and an overspeed application is initiated, the emergency application portion functions as explained under safety control.

1072-Q.—How many relayair valve units are used with the H-24-E Relayair Valve? A.—Two, Cut-Off Valve and Overspeed Application Valve.

1073-Q.—What additional unit is supplied for the H-24-C Relayair valve Unit? A.—An Overspeed Suppression Relayair Valve.

1074-Q.—How does it function? A.—It operates to suppress an overspeed brake application when the brake valve handle is placed in FIRST SERVICE POSITION (Rotair valve in FRT. position) or when a light service application is made.

1075-Q.—Is this suppression permanent? A.—No. This will cause a 20-second suppression after which time the brake valve must be placed in service position for further temporary suppression or the speed reduced below the speed allowed.

1076-Q.—What will cause a permanent suppression? A.—About 15 lb. service reduction which will operate the cut-off relayair valve.

1077-Q.—When charging, how does the air flow through the H-24-C Relayair Valve Unit. A.—From pipe *10* through the cut-off valve of the H-24-C Relayair valve through the overspeed suppression valve to passage *7* and to the overspeed application valve.

1078-Q.—What happens when an overspeed occurs? A.—If the train speed is not reduced below the overspeed setting to re-energize the Fa-4 magnet valve in approximately six seconds, the parts function as described for the H-24-E Relayair valve unit except that the air passes through speed application valve.

1079-Q.—Describe the operation to initiate a temporary suppression of an overspeed (Service application used) Portion. A.—As previously stated, this is accomplished by placing automatic brake valve handle in First Service position (rotair valve in FRT. position) or service position before the six second warning time has elapsed. This admits air through the brake valve rotary valve and seat into either the *26* or *17* line to the top of the overspeed suppression valve diaphragm *10*

Steam Locomotive Boilers

By George M. Davies

Tapered Shell Courses

Q.—On the older types of steam locomotives, the boiler invariably has a pronounced taper in one of the shell courses. What was the reason for designing the boilers in this manner?—F. R. E.

A.—The application of the conical course in the older type of locomotive boilers was usually brought about by the necessity of distributing the weight of the locomotive. This weight distribution generally required a reduction of the front-end weight of the boiler which was accomplished by reducing the diameter of the boiler at the front end, limiting the diameter of the front tube sheet to that required for the application of the dry pipe, tubes and flues, thus making the diameter at the front of the boiler considerable smaller than the diameter at the firebox end, thus, a conical or tapered connection was required in the shell between the firebox and the front tube sheet.

Grooving in Seams

Q.—What is the cause of grooving along the bottom of the circumferential seam of a locomotive boiler; the grooving generally starts in the shell plate along the inside caulking edge of the circumferential seam and always at the bottom?—R. K. J.

A.—Grooving along the inside of the shell plate at the inside caulking edge of the circumferential seam, particularly at the bottom of the boiler is due to expansion and contraction of the boiler shell, generally due to the uneven stresses that are set up due to the water in the bottom of the boiler having a lower temperature than the water and steam at the top, which results in the length of the boiler at the top becoming greater than the length at the bottom causing the barrel of the boiler to bow. This action is continual and eventually weakens the metal at the edge of the circumferential seam, at which point a hinge action takes place, this stressing of the plate, combined with the action of the water, causes the plate to deteriorate with the resultant grooving of the plate. The same stress condition also exists along the outside caulking edge but since there is no water action to combine with the stresses set up due to the expansion and contraction of the shell, deterioration of the plate does not develop.

Holes in Welded Seams

Q.—Is it permissible to drill holes through the welded seams of an all welded locomotive boiler?—F. W. P.

A.—It would not be permissible to drill holes in the longitudinal seam of an all-welded boiler, in that, the general practice on such boilers is to base the allowable working pressure on a welded joint efficiency of 90 per cent of the lowest tensile strength of the plate. This joint efficiency is for a continuous welded seam and makes no provision for a possible ligament efficiency that would result from drilling holes in the welded seam.

The A.S.M.E. Code provides that unreinforced holes may be machine-cut through welded seams that have been stress-relieved and radiographed. The joint efficiency as well as the ligament efficiency shall be considered in calculating the thickness of the plate.

Which Joint?

Q.—In butt welding plates 3/8 inch or over in thickness, should the single or double vee butt joint be used?—E.M.E.

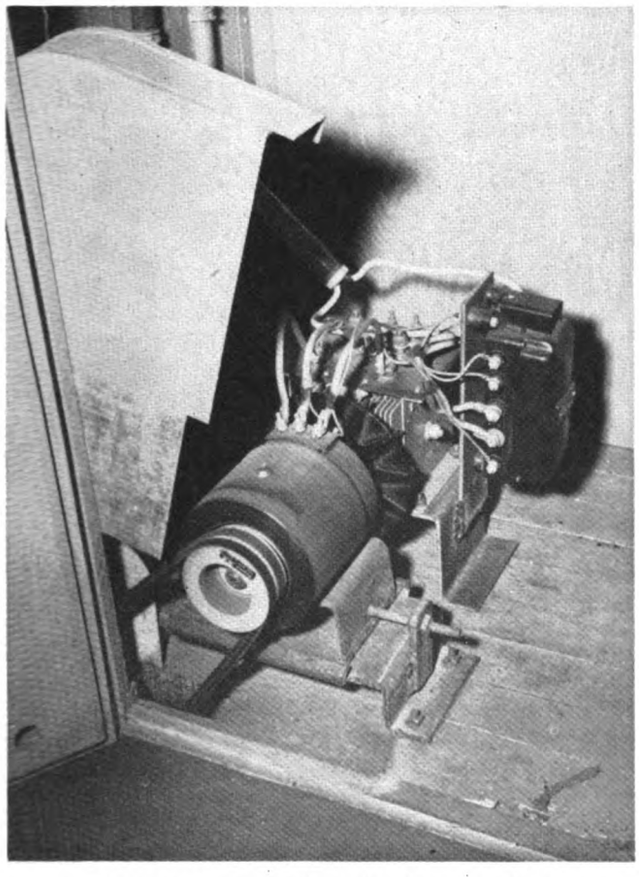
A.—The single or double vee butt joint is suitable for welding plates 3/8 inch or over in thickness for all usual load conditions. The double vee butt joint is generally used for plates of greater thickness than the single vee and for work which can be welded from both sides. The cost of preparation for double vee joints is greater than for the single vee but the double vee requires approximately half as much electrode to make the weld.

All other considerations being equal, the cost of machining the weld, plus the cost of electrode for both the single and double vee weld should be computed and the joint selection made accordingly.

ELECTRICAL SECTION

Twelve-Volt Caboose Power for Radio

Missouri Pacific's large scale train communication program made economically practicable by the adoption of 12-volt caboose radio power plants



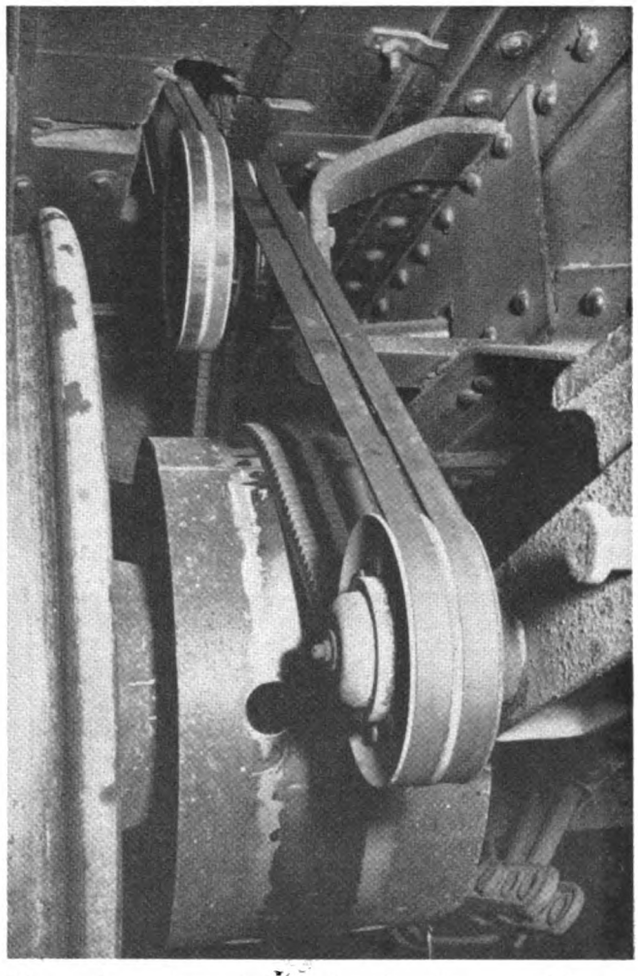
The generator, rectifier and voltage regulator

PROJECTS in service and authorized on the Missouri Pacific will result in the application of radio train communication equipment to 15 steam locomotives, 122 diesel-electric locomotive A units, 110 cabooses, and 12 wayside stations on 1,540 miles of road.

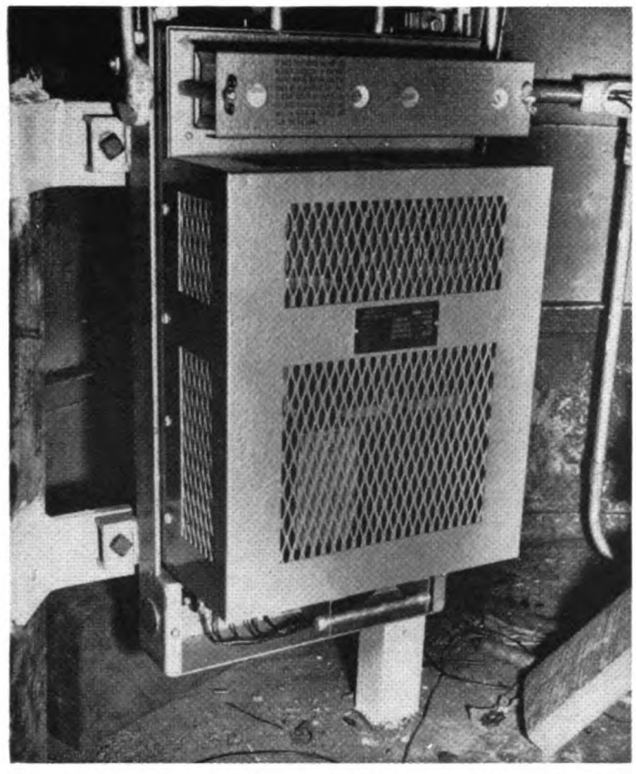
The overall costs for train communication were decidedly reduced, in 1950, by adopting radio on the cabooses which operates on 12 volts d.c. The reduction in the cost of power supply on each caboose, to approximately $700 installed, is one of several factors that made it practicable to install train radio communication extensively on this road.

The radio equipment on the cabooses operates on a 12-volt d.c. power supply. This energy is supplied by two 6-volt, 240 amp.-hr. lead acid batteries, which are charged by a Leece-Neville belt-connected, axle-driven, a.c. generator, Model 5150G6, rated at 14 volts, and maximum of 75-amp. output. This machine cuts in at 8 m.p.h., and above that speed it feeds through a dry-plate rectifier, Model 1004-C, and a Model 3256R6 regulator, also furnished by Leece-Neville, to charge the storage battery.

A multiplying V-belt drive, developed by the Dayton Rubber Company, is used to drive the generator.



View under a caboose showing the axle-pulley, one of the two idlers in front and above, the jack shaft with its multiplying pulleys and the second pair of belts running to the generator mounted on the caboose floor



Vibrator converter supplies 180-volt plate current to the radio

The pulley on the car axle is 19 in. in diameter and 10 in. wide. The backs of the duplex V-belts run on this axle pulley. The faces of the V-belts run on two idlers, one ahead and one to the rear of the axle pulley, and the V-belts also go up over a pulley on a fixed shaft that has a second pulley with two belts that go up through the floor of the caboose to the pulley on the shaft of the generator. At 10 m.p.h. the generator rotates at about 680 r.p.m., and at 40 m.p.h. about 2,720 r.p.m.

On each diesel locomotive A unit, the radio and power supply are complete and independent, so that these A units can be switched around to meet requirements for road service without any changes in the radio. On each locomotive A unit, power is taken from the starting battery to operate a Cornell-Dubilier Model 3264 vibrator converter to furnish 115 volts a.c. A power supply, included as part of the radio equipment, converts the 117-volt a.c. to the proper transmitter and receiver plate and filament voltages.

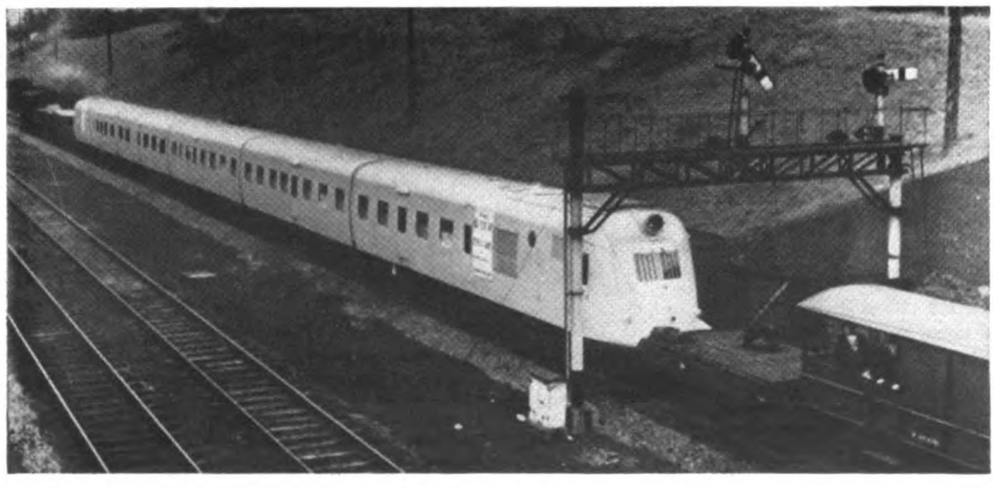
On the caboose the radio receiver and transmitter filaments are connected directly across the 12-volt storage battery. Receiver plate voltage of 180 volts d.c. is supplied by a synchronous vibrator fed from the 12-volt storage battery. Transmitter plate voltage of 420 volts d.c. is supplied by a small dynamotor actuated from the 12-volt storage battery when the push-to-talk button in the handset is pressed. These dynamotors are made by the Carter Motor Company, and have a rated output of 420 volts, d.c., 0.280 amp., at 5,700 r.p.m. The discharge from the battery, when receiving is approximately 11 amp.; and when transmitting, about 30 amp.

The train radio equipment installed on the Missouri Pacific in 1950 is the FMTU-80 type made by Motorola, Inc. The same type of equipment is used interchangeably in locomotives, cabooses and fixed wayside offices. At present, all road freight train radio equipment, locomotives, cabooses and way stations operate on the Missouri Pacific's assigned end-to-end frequency of 160.41 mc. However, plans are under way to adopt a dual-frequency system to eliminate interference between mobile and way stations, which is expected to result from the increase in radio equipment to be installed in 1951, and from additional base stations to be installed later. Crystal oscillator switching will be used as base stations and on mobile units to eliminate necessity for dual equipment and its resultant increase in power plant drain.

Records kept of an early installation on this railroad indicated that radio equipped trains moved over a specified 100-mile engine district on an average of 30 minutes faster than non-radio equipped trains. The same records indicated a virtual elimination of train break-in-twos due to air being set from the rear end of freight trains on account of hot boxes or other circumstances. These are the principal reasons the Missouri Pacific decided to expand its freight train radio communication system.

The radio installations on the Missouri Pacific were planned and installed by railroad forces under the direction of W. Rogers, superintendent telegraph, and R. A. Hendrie, assistant superintendent telegraph, and under the direct supervision of L. E. Verbarg, telephone engineer.

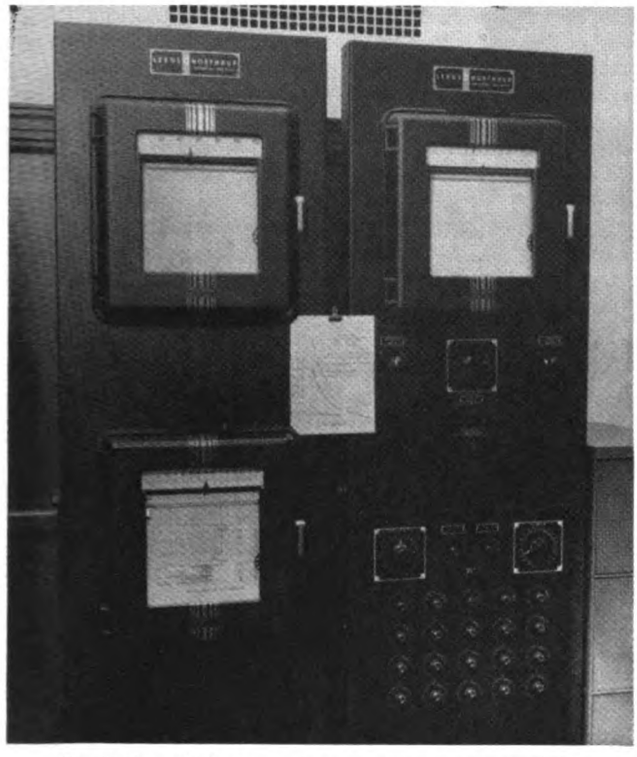
* * *



One of the two diesel-electric articulated trains recently built for the Egyptian State Railways by the English Electric Company Ltd. The two trains are the first part of an order for ten similar trains, totaling £3,000,000 Each train will accommodate 172 first and second-class passengers. They are capable of speeds up to 75 m.p.h. and they will operate between Cairo and Alexandria, Egypt, on a schedule of a little over two hours for the 130-mile trip

Train Performance Calculator*

The Pennsylvania develops electro-mechanical brain for computing the optimum performance of all kinds of motive power



Front view of the new train performance calculator

AN ELECTRO-mechanical train performance calculator was recently placed in service by the Pennsylvania in Philadelphia, Pa. By means of measuring and recording instruments, this device quickly computes and records information required to determine the economics, schedules, and proper tonnage ratings for all types of motive power. Such information was previously assembled from a large number of tedious, step-by-step mathematical calculations. This machine performs and records the necessary calculations for a high-speed passenger train in actual train running time.

The procedure generally followed to calculate the performance of a given train over a given route is first to assemble pertinent data relating to motive power tractive effort, train resistance, effective track grade operating restrictions, and schedule stops. Next, train acceleration at any speed and the limitations on use of acceleration are determined. Thereafter, the principles of mechanics are applied to calculate step by step the speed developed, the time required. and the distance covered by the train as it is assumed to move along a selected route. Step-by-step calculations are tedious and consume considerably more time than the actual train would need to operate over the route.

In this calculator, net acceleration is expressed as a small voltage. As this voltage is measured, it is mechanically integrated with respect to time to control a second voltage proportional to speed. Speed voltage is, in turn, measured and integrated with respect to time. The speed integrator, through relays, controls the speed of a motor to advance a chart at a rate proportional to distance covered.

The basic elements of the calculator are three: self-balancing, potentiometer-type, curve-drawing instruments, electricially interconnected, and a low-energy auxiliary circuit, all of which are mounted on two steel panels. The auxiliary circuit contains apparatus necessary to represent effective forces which influence the movement of the train and to simulate three types of train motion: acceleration, operation at fixed speed, and braking. All the electrical energy required to operate the machine is supplied through two 3-amp. fuses from the 110-volt office lighting system.

Instruments

The three instruments are an acceleration recorder, a speed recorder, and a distance recorder. These instruments, as well as the auxiliary apparatus, were previously developed for other applications and have been adapted to the calculator with no changes in basic design.

The acceleration recorder measures a voltage proportional to the totalized motive power and track acceleration forces, or to the braking force, and provides a permanent record of train acceleration at any time. A pointer attached to the recording pen carriage indicates instantaneous acceleration along the lower instrument scale which is calibrated from minus 2.4 to plus 2.4 m.p.h. per sec. A mechanical integrating device operates in conjunction with the acceleration measuring mechanism and moves a contact over a straight section of slidewire, located behind the upper instrument scale. This contact is attached to a pointer which indicates speed on the upper instrument scale calibrated from 0 to 120 m.p.h. The straight slidewire transmits to the speed recorder a voltage proportional to speed.

The speed recorder measures this voltage and provides a record of train speed at any time. A pointer associated with the pen indicates speed on a scale calibrated from 0 to 120 m.p.h. This instrument contains two retransmitting slidewires and a mechanical integrating device which are positioned by the speed measuring mechanism. One slidewire transmits to the acceleration recorder a voltage proportional to acceleration; the other transmits to the distance recorder a voltage proportional to speed. An integrating device, through relays and cam-actuated contacts, regulates the speed of the special chart-drive motor in the distance recorder.

The distance recorder measures speed and provides a permanent record of speed on a prepared chart which

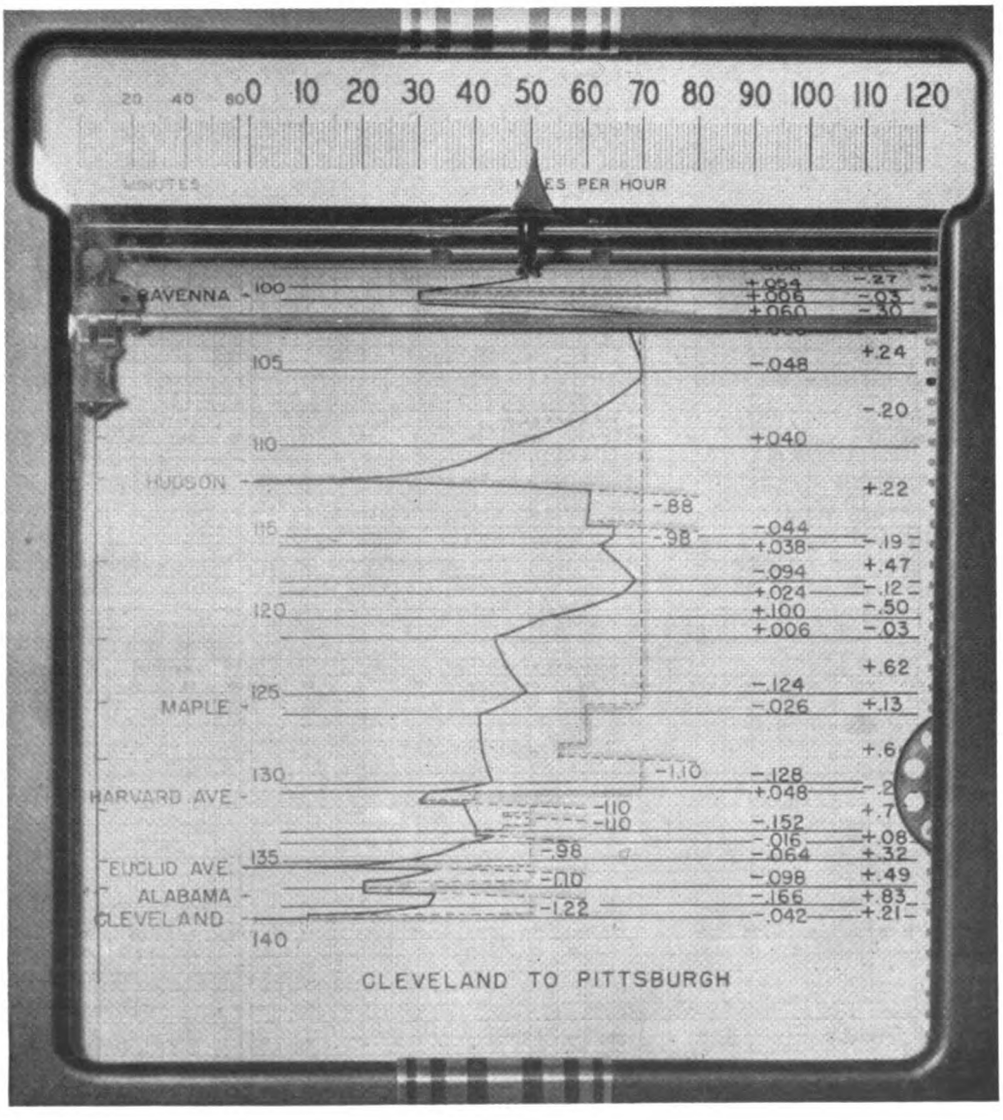
represents the track. A curve-drawing pen represents the train. A pointer moving with the pen indicates speed along the right-hand section of the instrument scale, calibrated from 0 to 120 m.p.h. A solenoid-operated pen, located under the left-hand section of the scale and actuated by a timing motor, provides a permanent record of time by drawing short horizontal lines at five-minute intervals. The left-hand sections of the scale and the chart are ruled from 0 to 60 minutes. This portion of the chart is completed manually, to show time in hours and minutes at any location, following conclusion of the calculation. The special chart-drive motor advances the chart in steps of 0.02 in. for each 0.1 mile of calculated performance.

Operation

Prior to making a calculation, the known data must be prepared and placed in the machine. The track information is plotted to scale on the speed distance portion of the chart in the distance recorder. It consists of effective track grades, equivalent acceleration values, speed restrictions, braking lines, required braking acceleration values, mileage designations, stations, and interlockings. The train information is reduced to terms of net acceleration on level tangent track. This information is translated into proportional voltage by adjusting rheostats, most of which are connected between fixed positions along a slide wire which is positioned automatically by the speed measuring mechanism.

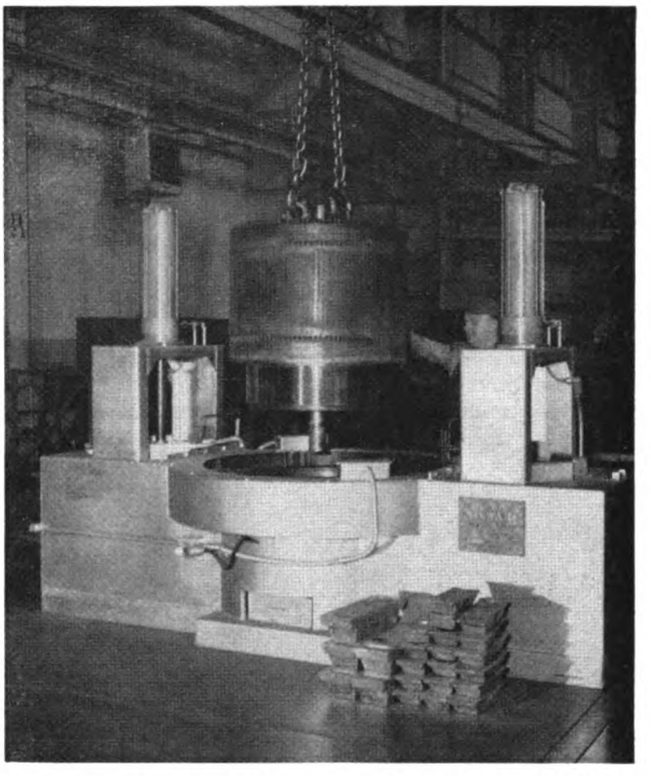
After the known data have been placed in the calculator, the power switch is turned on. Calculation and recording are fully automatic except for changes of track grade and for changes in type of motion. This information is supplied to the calculator by adjustment of a rheostat to regulate a voltage proportional to the acceleration produced by effective track grade (or proportional to the retardation required for braking) and by operation of a three-position switch to simulate type of motion. Progress of the speed trace on the prepared distance chart determines the nature and extent of each adjustment. One man can handle both adjustments without difficulty. He must, however, carefully follow the speed trace and other indications on the speed-distance chart.

The train performance calculator has been used extensively by Pennsylvania engineers to analyze and to predetermine performance of Diesel-electric, straight electric, and steam locomotives, and of multiple-unit cars.



Speed-distance chart in the distance recorder. A number of road tests under specified conditions have been confirmed with the calculator

It is particularly effective in making comparisons between different types and sizes of motive power on the same train. No special allowances are necessary for track conditions, locomotive handling, or equipment defects, the results being wholly dependent upon information supplied. A number of road tests under specified conditions have been confirmed with the calculator. Momentum operation of long freight trains on short ruling grades and the use of short-time ratings on electric propulsion apparatus have been investigated to a much greater extent than was considered practicable with step-by-step calculations. Noiseless operation and simple controls make the new train performance calculator a valuable addition to a modern railroad engineering office.



Generator armature soldering machine used in the West Burlington Shops of the C. B. & Q.

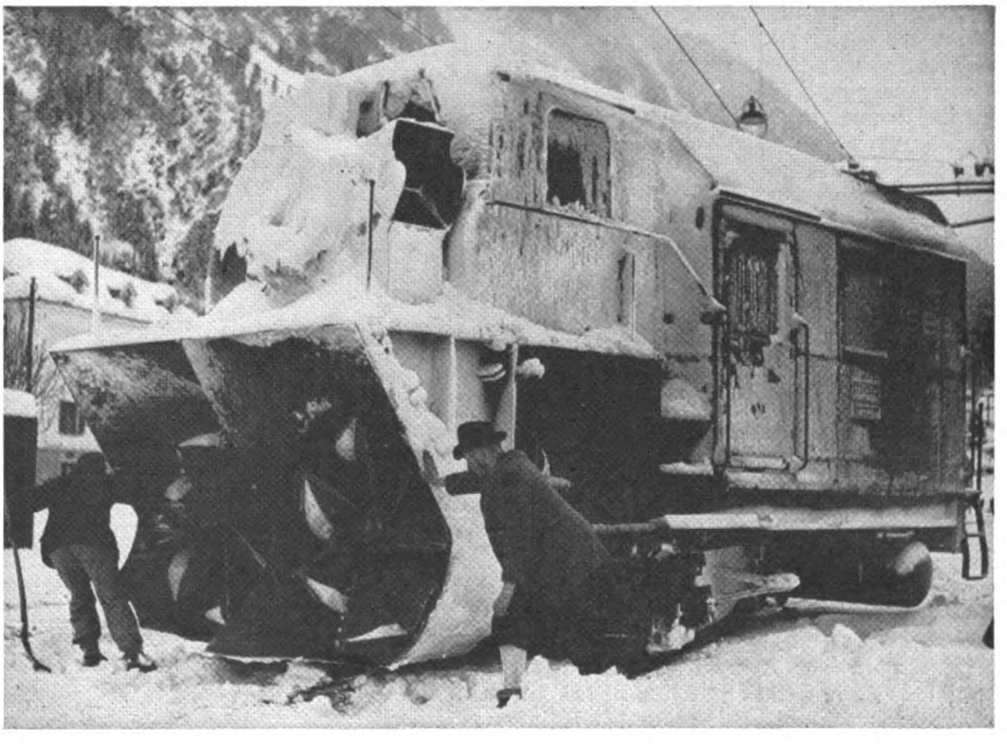
Burlington Pot-Solders Diesel Generators

The Chicago, Burlington and Quincy has recently installed in its West Burlington, Iowa shops, an electrically heated commutator soldering machine, for soldering commutators of rewound diesel-electric main generator armatures. The Burlington was one of the first railroads to use this method, having employed a smaller, shop-made machine on traction motors since 1942.

The type solder used is block tin and the machine is capable of soldering all main generator armatures in service on the Burlington by the use of various sized adapters. The tin is melted by two resistance-type electrical heaters at each end of the machine, and after the armature is lowered through the ring against an asbestos gasket, the solder is lifted into the center portion against the risers by lowering steel plugs into the two solder containers.

The machine shown is a Stewart Sunbeam commutator soldering machine, manufactured by the Industrial Furnace Division of the Sunbeam Corporation, Chicago.

* * *



Swiss electric snowplow, mounted on a single truck, is equipped with its own turntable and may be turned by two men. Power for motors driving the rotors is supplied by cables from the electric locomotive which pushes the plow. This type rotary snowplow clears the snow over a width of 10¼ ft., at a speed of one to six m.p.h., and can throw the snow either to the left or to the right

CONSULTING DEPARTMENT

Winding insulation

Tester for D. C. Armatures

Can you tell me how the General Electric surge tester for traction motor armatures works, showing a diagram of the circuits involved, and also tell me just what information it gives to the man making the test?

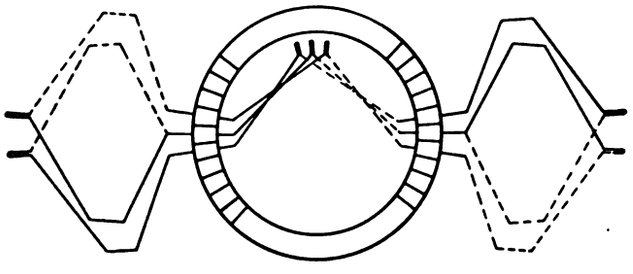


Fig. 1—Simplified connections for two coils of a parallel-wound, equalized armature

The General Electric surge tester for traction motor armatures represents a new application of this method of testing. It is a quick and effective means of determining the adequacy of turn-to-turn insulation so essential to dependable transportation motor armatures. It makes possible reliable tests at voltages considerably above operating levels.

Conventional induced voltage tests, such as used on series wound armatures, are not applicable to transportation motor armatures with their parallel winding. This is evident from an examination of Fig. 1, which shows the simplified connections for two coils of a parallel wound equalized armature. The success of the repetitive type surge test on high impedance windings suggested that it might be adopted to low-impedance armature testing.

A low-impedance surge tester was built and successfully used during World War II. However, its capacity was definitely limited by the current capacity of the thyratrons then available. Adequate testing potentials for transportation motors of post-war design required currents far in excess of thyratron capacity. Experimental testers of high-current capacity were tried and finally a successful tester was built, using ignitrons.

Fundamentally, the surge generator for this tester consists of a capacitor (C in Fig. 2) charged to some predetermined voltage through a rectifier tube during one-half cycle of the power supply. The capacitor is then discharged into the winding under test during the other half cycle of the power supply. This sequence is repeated as long as power is supplied to the circuit.

Coaxial cables are used to conduct the surge current to the winding under test to reduce the impedance in the surge circuit. The transformer primary supply is adjustable to allow proper selection of test potentials.

Two ignitrons are used, connected in inverse parallel,

Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical and Electrical Engineer, 30 Church Street, New York 7.

Proper maintenance of diesels requires facilities, material and skilled men interested in the work. How can morale be made an active factor in the diesel shop?

or "back-to-back", to insure complete oscillatory discharge of the capacitor. Ignitron firing is accomplished by discharging the capacitors C_2 and C_3, which are charged during the same part of the power cycle as the surge capacitor, through thyratrons T_1 and T_2 into the ignitors to start the conducting arc.

Thyratron grid control consists of a 30-volt negative bias modulated by a 60-cycle voltage of about 250 volts on the thyratron firing the inverse ignitron and a lower 60-cycle voltage modulating the grid of the forward firing circuit. The inverse ignitron is fired first to assure the existence of an arc for the first inverse surge after the foward ignitron is made conducting. An inductance L, in series with the surge current, provides a small voltage to initiate the oscilloscope sweep circuit and insure perfect synchronization.

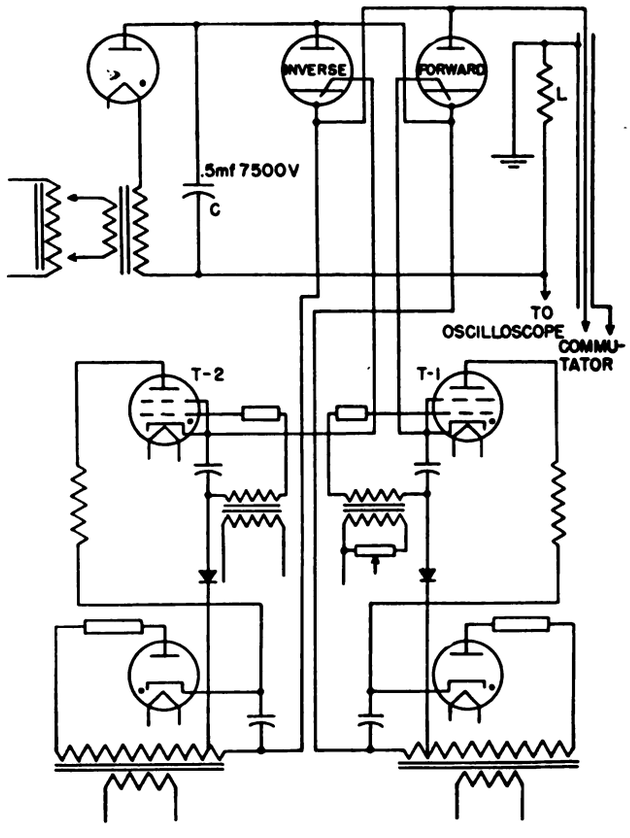


Fig. 2—Wiring diagram of the surge generator

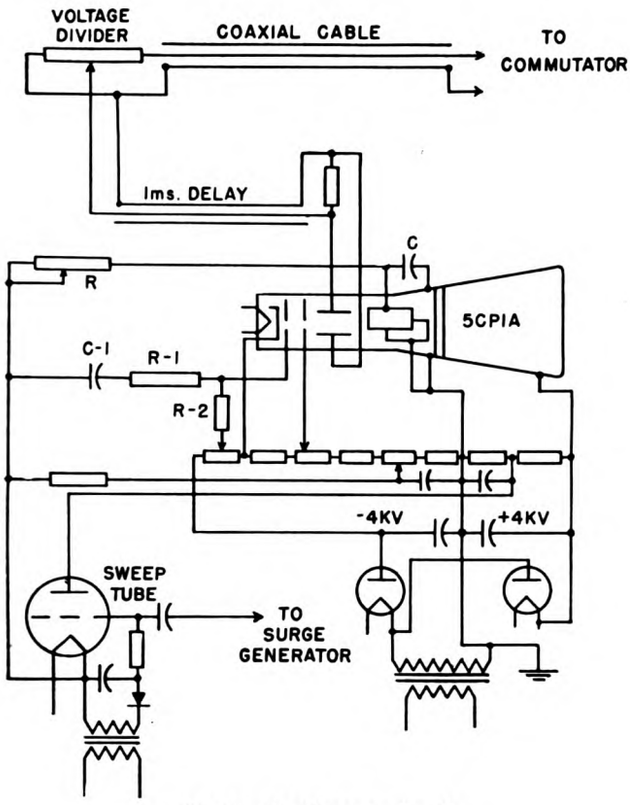


Fig. 3—Oscilloscope circuits

The oscilloscope circuits are shown in Fig. 3. The sweep tube is a small thyratron and serves two functions. It provides a positive potential on the intensity grid to initiate a trace beam, and also provides sweep potential.

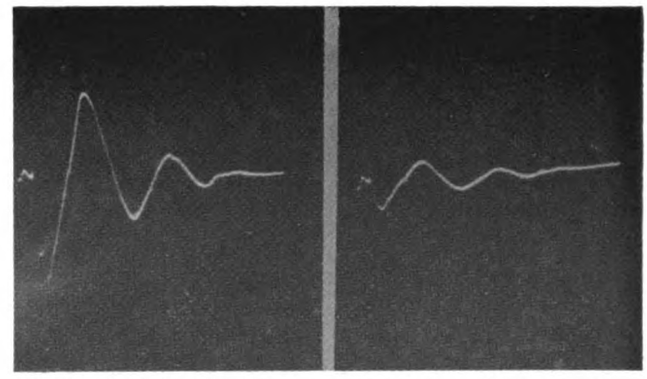


Fig. 5—(left) Surge wave on a very low impedance armature.
Fig. 6—(right) Effect of a deliberate short placed between the commutator segments at the equalized connection

The time axis of the sweep is controlled through a variable resistance R which changes the charging rate of capacitor C. Because the surge current triggers the sweep current, it was found necessary to place a two-microsecond delay cable in the vertical deflection plate circuit to assure recording the first surge peak.

A special fixture holds the surge contacts and the measuring contacts. Two shorting contacts are also incorporated in it. The purpose of the shorting contacts is to short the commutator segments approximately one pole pitch to prevent the build-up of induced voltage to excessive values. The shorting contacts have interlock switches that are in series with interlock switches in the fixture handles. Surge power cannot be applied until the shorting contacts are in place and both hands of the operator are in position, as shown in Fig. 4. This prevents accidental contact with conductors connected to the surge circuit.

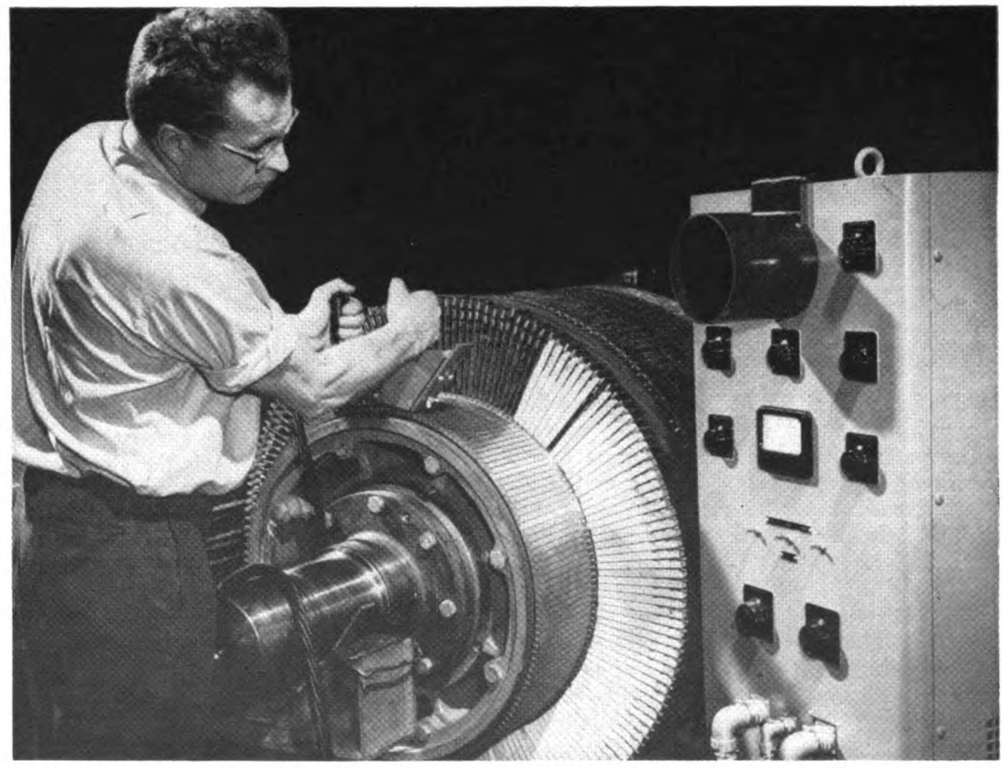


Fig. 4—The newest type of General Electric surge tester. No voltage can be applied to the armature until the operator's hands are in the position shown

An oscillogram of a surge wave on a very low impedance armature is shown in Fig. 5. It is a typical surge shape; has a peak value of 500 volts on the first surge; a frequency of approximately 200 kc.; and surge current crest value around 1,500 amp.

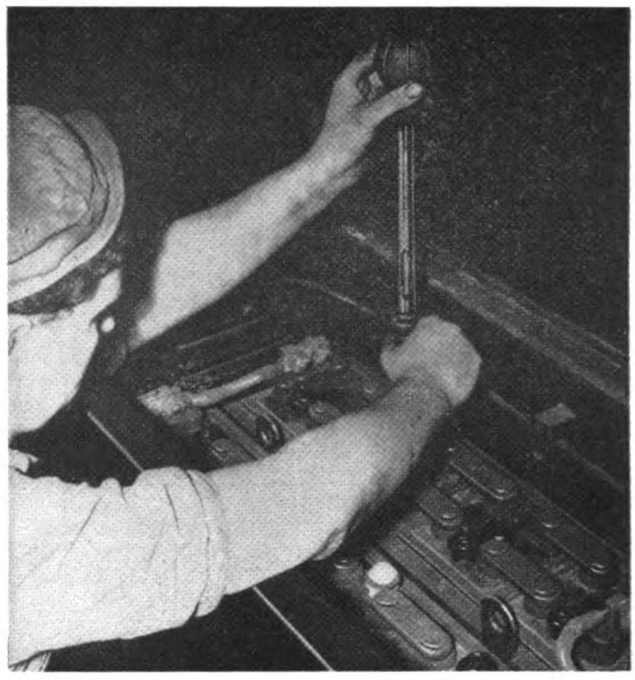
The effect of a deliberate short placed between the commutator segments at the equalized connections is indicated by Fig. 6. The voltage of the surge is approximately 100 volts. No attempt was made to measure the crest value of the surge current.

A pilot model of this surge tester has been in use at the Erie Works of the General Electric Company for about one year. The current limitations have not been determined as the tester has been able to handle any armature now manufactured and still it has sufficient reserve capacity to provide tests at higher voltages if desired. Maintenance has been extremely low compared to the previous thyratron powered tester.

Experience to date indicates that the tester is simple, rugged, and has ample voltage and current capacity to adequately test a wide variety of apparatus. Its voltage range is from less than 100 volts to 7,500-volt peak. It is not limited to d.c. motor armatures, but has been used on field coils up to 100 turns, stator coils, and other work of similar nature.

The newest tester is shown in Fig. 7. It is expected that it will find an expanding field of use as application experience is gained, and point the way to improved design and manufacturing techniques.

F. H. CATLIN
General Electric Company



A specific gravity check should be one of the first things done after receiving a new battery. Notice that the mechanic in the photograph has his eyes at the same level as the hydrometer in order to get an accurate reading

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—What should be done after receiving a new battery?

A.—When a new battery is received, the Electric Storage Battery Company recommends that it be examined for loss or spillage of electrolyte en route. Remove the vent plugs and note the height of the electrolyte. The electrolyte level of all cells should be 1/8 in. below the bottom of the filling tubes, unless some has been spilled during shipment. If there is any evidence of spillage, restore the level by adding electrolyte of the same specific gravity as that in the other cells. If no electrolyte is on hand, add approved water, and make a notation to this effect in the battery record.

Check the specific gravity of the electrolyte as shown in the figure. If it is 20 points or more below the fully charged gravity as shown on the nameplate, give the battery a freshening charge. Charge at the finishing rate shown on the nameplate, as long as the hourly specific gravity readings of the lowest cell show an increase, and continue charging for three hours after the last increase shown.

Q.—Why is good ventilation of the locomotive battery compartment necessary?

A.—A free flow of outside air over and around the battery helps to dissipate heat and to prevent excessively high operating temperatures, especially if the voltage regulator is not functioning properly or if the locomotive operates in a very warm climate. Based on long experience, the Electric Storage Battery Company can testify that a well ventilated battery compartment promotes long battery life.

The screens (which should be 1/4 in. mesh) over the ventilating openings, must be kept clean. Outside matter, such as dirt and paint, should not be allowed to clog screens. Therefore, before placing the battery trays in the compartment make sure that all ventilating openings meet these requirements. Lack of ventilation is one cause of high battery temperatures.

S. K. LESSEY
The Electric Storage Battery Company

Car Electrical Equipment

Questions and Answers

Q.—What is a generator regulator?

A.—A generator regulator regulates the voltage and limits the current produced by the generator. At low train speeds the generator field current is at a maximum to produce rated voltage and current. As the train speed increases, the regulator decreases the field current to maintain a constant voltage. If at any train speed the current being taken from the generator tends to exceed that for which the regulator is set, the generator field current is automatically reduced to limit the current to normal value.

Q.—What is a reverse current relay?

A.—A reverse current relay automatically connects the generator to the battery and load when the voltage pro-

duced by the generator is slightly above that of the battery and disconnects the generator when its voltage falls slightly below that of the battery. The reverse current relay has a current coil which holds the relay contacts tightly closed when current is being delivered by the generator. When the train slows down to a point where the voltage produced by the generator is below battery voltage, the reverse current flowing from the battery to the generator through the relay causes it to open.

Q.—What is a load regulator?

A.—A load regulator regulates the voltage on the car lamps or other load. To charge the batteries, the generator voltage is maintained at a higher value than the normal battery voltage. The load regulator places a variable resistor in series with the load to hold constant voltage on the load regardless of the magnitude of the load or whether power is being furnished from the generator or from the battery.

Q.—What is a genemotor?

A.—A genemotor is a combination d.c. generator and a three-phase a.c. motor mounted in a single frame. The genemotor is driven from the car axle when the car is on the road. When standing in the yard, the motor may be connected to an a.c. supply to drive the generator. An automatic clutch disconnects the genemotor from the axle drive when the car is standing still.

Q.—What is the purpose of the bias coil used in the generator regulator in combination with a genemotor?

A.—The bias coil limits the current which can be drawn from the generator when a lower kw. output is desired from a genemotor being driven by the a.c. motor. The bias coil is a potential coil wound inside the series coil of the regulator and increases the pull of the current solenoid proportional to the reduction in current output desired. The need for such a device is prompted by the lack, in most places, of a.c. standby facilities of sufficient capacity to drive the full rated load of the generator.

L. B. HADDAD

Freon Filter and Compressor

By G. Kleaver*

An average of two gallons or more of oil is removed from the air-conditioning units on each passenger car that is overhauled at the Southern Pacific's General Shops at Los Angeles by means of the portable filter and compressor unit shown in the illustration. When this quantity of oil is removed from the system, the cooling effect is greatly increased. It also reduces the load on the compressor.

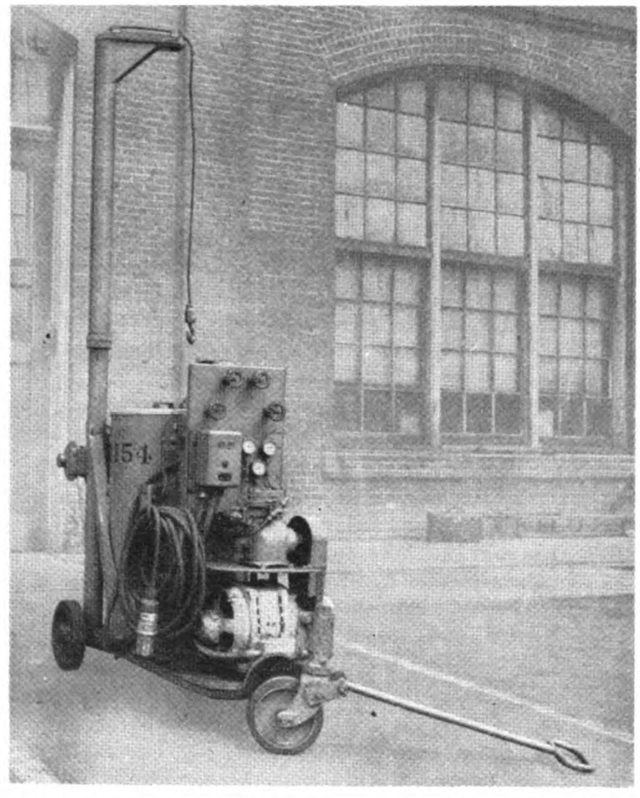
The unit consists of a twin compressor, motor, water pump, oil trap, dehydrator, open tank, and a crane and winch for handling freon tanks, all mounted on a three-wheel truck. The tank on which appears the number 154 is the open tank which contains water. For cooling, freon tanks are placed in this open tank. They are centered in the water by fins, welded to the inside of the open tank.

Between the open tank, and the control panel, is an oil filter tank, 30 in. high and 10¼ in. in diameter, containing 18 baffles which are spaced approximately one inch apart. These baffles extend from the top of the tank downward.

Filtering Process

After a car is pumped down, the tank of dirty freon is placed upside down and connected to the filtering unit. The liquid freon and oil flows into the oil filter tank where the oil settles to the bottom.

The compressor is then used to draw the freon in the form of gas from the top of the oil filter tank through a dehydrator and compress it into a clean freon tank. To facilitate this process, the crane and winch are used to place the clean freon tank into the open water tank with a spray of water circulating around the freon tank. The water is drawn from the open tank and sprayed over the top of the freon tank by a circulating pump driven by the same motor used to drive the compressor. After the freon has been cleaned and transferred, the oil is drained from the oil filter tank through a valve at the bottom of the tank.



The valves make it possible to draw a vacuum or apply pressure to the same pipe line. The lower gauge registers 0 to 600 lb. pressure for testing. The other two gauges serve the dirty and clean freon tanks and each reads 0 to 30 in. vacuum and 0 to 150 lb. pressure

The unit is also used to test Waukesha sub-cooler coils before they are mounted on the cars. The coils are tested with freon at 200 lb. pressure. With a cross-over system of valves, the freon is put in and drawn out of the coil without changing any connections.

* Electrician, Los Angeles General Shops, Southern Pacific Company, Los Angeles, Cal.

EDITORIALS

Why Is Steam Neglected?

Discussing the future of various types of motive power in England, R. A. Riddles, in his presidential address before the (British) Institution of Locomotive Engineers on November 18 last, said that, if one accepted the eventual replacement of steam on proved economic grounds by some other form of motive power, "19,000 steam locomotives will take a long time to liquidate on any possible financial policy and, while a single one of them remains, it will pay a better return if well designed and maintained than if left unimproved and neglected. I think there is a case for continuing the development of the steam engine along with the diesels and electrics for some time yet."

This statement brings up a question which has been discussed in these columns before; that is, the extent to which the steam locomotive and its maintenance are being neglected in America because the diesel-electric locomotive has become the center of interest. Conditions determining the economics of the situation differ in England and the United States. In England domestic coal is available, but oil is not. In the United States both fuels are available in relative abundance. In England the unit capacity of motive power is moderate as compared with that in America. Here steam locomotive unit capacity has crowded economic limits, while the diesel locomotive is made up of a combination of units of moderate capacity which offer a considerable degree of flexibility in utilization. These are at least some of the factors which have caused dieselization to proceed rapidly since the end of 1944 when there were 317 diesel-electric road locomotives in service. In six years the number has increased to 3,894 (8,046 units) and the proportion of train mileage handled by diesels has reached 53.5 per cent in the case of passenger service and 38.8 per cent in the case of freight service.

This accounts for the difference in the attitude of American railroads toward the continued improvement of the steam locomotive and of the facilities for its servicing and maintenance and that expressed by Mr. Riddles. The demand for capital for additions and improvements to railway plant and facilities has always been ahead of the credit available to the railways. The items in improvement budgets have always had to be carefully selected so that the expenditures of available capital would produce the maximum possible return. The greatest current improvement in motive-power service on American railways is that produced by the extension of diesel locomotive ownership. To undertake major programs of steam locomotive betterment or improvement in repair and servicing facilities would divert capital which might otherwise be spent for the purchase of additional diesel locomotives and the retirement of additional steam locomotives. It would seem, therefore, that only in cases where definite limits are set on the extent of dieselization and these limits have been reached is there likely to be much consideration given to operating improvements and expense reductions which can be attained by money spent for steam-locomotive and shop betterments.

The Neglected Tool

Proper maintenance of diesel-electric locomotives requires facilities, material and skilled men interested in the work. Many fine service and repair shops have been built and more are in process of construction or enlargement. Circumstances indicate that material will be in short supply, but even under rationing, diesel repair parts will enjoy a high priority. Good men, too, are in short supply and it is this factor which most acutely affects diesel maintenance. The situation calls for education and training and the building of interest and pride in work done.

Under present circumstances, it is common in many places for a young man to enter railroad service feeling high enthusiasm over the fact that he is going to work on the big diesels. Then, in all probability, he will encounter the too common atmosphere of a railroad shop. He will discover soldiering in a great variety of forms, he will encounter bickering over divisions of work and probably discover a lack of willingness on the part of older men to pass along information. This dates back to the earlier days of steam power when a mechanic setting valves would hide the tram mark with his thumb to prevent his apprentice from discovering how it was done. The young man will also see older men, inexperienced in diesel work, bid in jobs he would like to have. And he will discover that the scope of his work will be so limited, that he will never be able to get the experience which he must have if he is ever to become one of the supervisory force. Older men, too, are affected by the circumstances and find themselves doing routine work in which there is little interest.

The idea that if each one does as little work as possible there will be work for all is still quite widely accepted. But this coin has another face. As railroad shop efficiency falls off, more work must be allocated to the outside shops and as railroad costs rise, more traffic moves to the highways and into the air.

Few men like to work in drudgery or under adverse conditions, and it appears that one of the most important factors now confronting the users of diesel locomotives is to devise means for improving the morale of maintenance forces and for building up an interest in the work which will redound to the benefit of both employee and employer. Shop facilities and materials are available.

The neglected tool is morale. The answer to the question of how to improve it is not easy. Probably there are many answers and in this issue, the *Railway Mechanical and Electrical Engineer* is asking its readers to contribute their thoughts on the matter. The question appears in the Consulting Department, page 78. Will you give us the benefit of your experience?

NEW BOOKS

THE DIESEL-ELECTRIC LOCOMOTIVE HANDBOOK—*Mechanical Equipment. By George McGowan, technical consultant. Published by Simmons-Boardman Publishing Corporation, New York. 276 pages, illustrated, 5½ in. by 8¼ in. Fabrikoid binding. Price, $4.95.*

This is the first of two books explaining the development, construction and operation of the diesel-electric locomotive. It has been written with the assumption that men who work on and operate these locomotives would like to know why they are built and operated in the manner they are, without having to wade through masses of technical details. Technical and maintenance details that do not contribute to this objective have been eliminated.

This book on mechanical subjects avoids the electrical aspects of the diesel-electric locomotive except where it is necessary to clarify the subject under discussion.

A brief history of the development of the diesel engine is included in relation to its first practical use in a locomotive in this country. The development of the diesel-electric locomotive from the first production types to the present day road locomotives has been shown. A description of the function and basic principles of the diesel engine is followed by a detailed description of the various types in railroad use and an explanation of the two- and four-cycle operation, supercharging, rating and horsepower calculations. Engineering fundamentals necessary for a proper understanding of the operation and ability of these engines is set forth and definitions of the common terms used in describing a diesel engine are made.

A section is devoted to describing a method commonly used to calculate, accurately, the proper tonnage ratings and operating speeds of any road locomotive in either freight or passenger service over any given profile.

A general lubricating and cooling system is described and the importance of this function to the operation of the locomotive is shown. Failures or damage possibly due to improper operation of this system are pointed out and the reasons for these damages and their relationship to the operation of the locomotive as a whole. The specifications of lubricating oil are given with a discussion of their importance to the lubricating qualities necessary.

The fuel system is described and the component parts are taken separately and their duties as a part of the whole are shown. The necessity for filters, the operation of various types of filters and their importance to the engine is brought out. Fuel oils are discussed and an explanation is made of the manner in which cetane numbers and/or diesel index for fuel oils is determined. The damage and indications of improper combustion due to defective fuel system, poor grade fuel oil, dirty system or improper use of the engine whether from wrong handling or insufficient maintenance are given.

The construction and development of the modern piston and the functions of the piston in addition to the transmitting power, the liners and water jackets, and piston rings are described. The importance of cooling and lubrication to the life and operation of the assembly and the engine as a whole is stressed.

Connecting rods, bearings and crankshafts are covered in another chapter. Construction, operation and stresses are discussed and the effects of torsional vibration are explained in relation to the use of dampers, balancing and the operation of the engine outside of the critical ranges to avoid this hazard.

Other chapters cover valves, timing, cylinder heads and governors.

The newest steam generator, for use in the passenger type road locomotives, is shown with illustrations. Operating procedure and trouble shooting is included.

The various types of air compressor drives, compressor operation and component parts are described separately.

A brief outline of the prospects for the new gas turbine as it compares to the diesel engine as a prime mover is taken up in another chapter. The major items of construction, maintenance, operation, fuel consumption and auxiliaries of the gas turbine and the diesel engine are compared.

The balance of the book is devoted to the builders of the larger diesel-electric locomotives. A detailed chapter describes equipment built by the American Locomotive Company, Baldwin-Lima-Hamilton, Fairbanks, Morse and General Motors diesel engines.

The book is liberal in its use of data, diagrams and illustrations of equipment. The text has been developed in such a manner as to enable the reader to follow the operation of the engine in a logical sequence and to clarify the operating instructions given with the equipment. The actual function and its cause and effect on the operation of the engine of each of the component parts has been described in the general sections. Trouble shooting or descriptions of operating faults has been general and applicable to any diesel to avoid any conflict with the specific operating instructions given by the builders with their equipment. No attempt has been made to add to or supplement specific instructions but rather to enable the operating man to analyze the operating faults he may find in service as a means of understanding, to the advantage of the equipment, the difficulties that will arise.

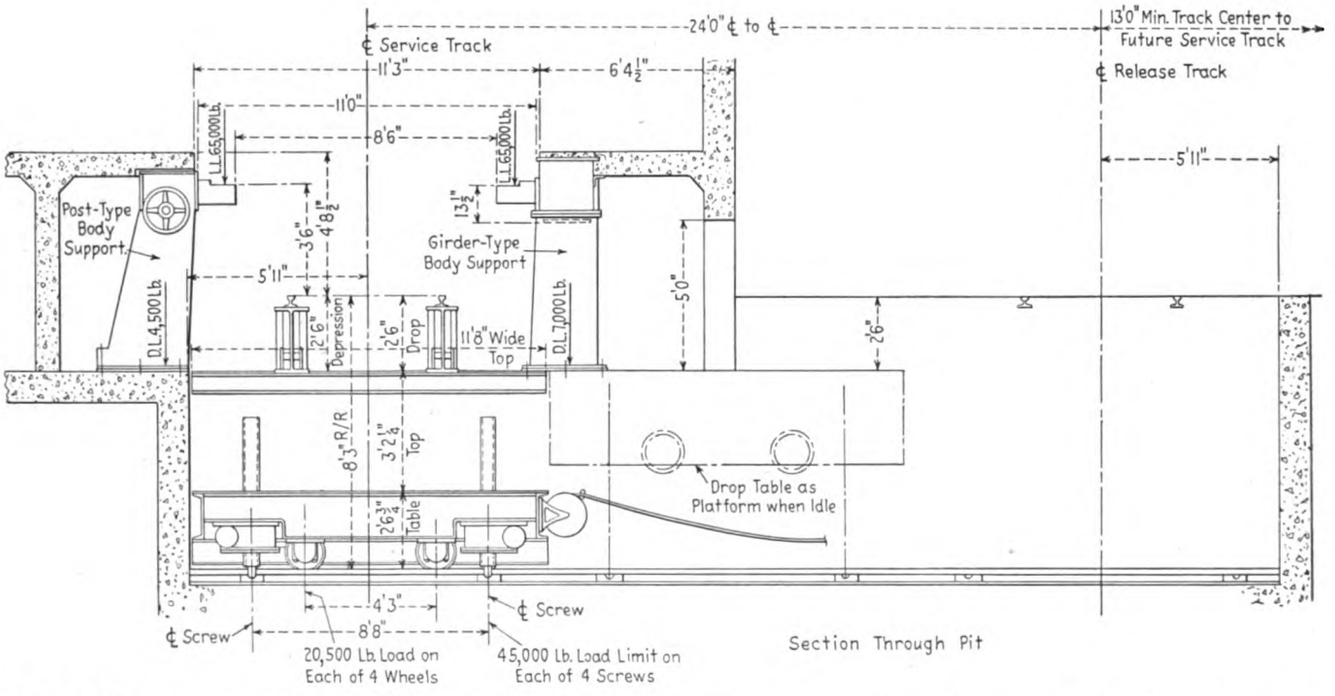
These two books have been prepared as a result of numerous questions by operating and maintenance men seeking information as to what makes wheels go round and why. It has been assumed that the designers of locomotives do not need technical information and that maintenance men have manuals furnished by builders. These books are for the multitude of railroad men in groups other than the above.

NEW DEVICES

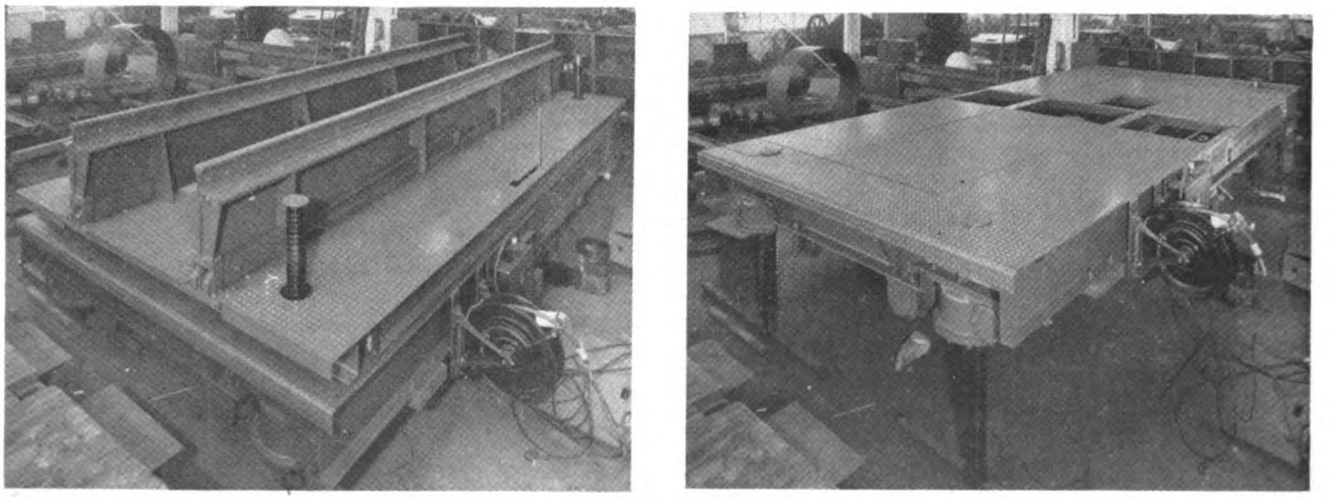
Diesel Shop Drop Table

The Illinois Central is now installing a Whiting Consolidated drop table at its new diesel shop at Harahan, La. The normal width of this type of drop table, operating in a shallow, open pit, is 15 ft., to give good working space for men on both sides of the locomotive. Such an installation at the Danville, Ill., diesel shop of the C. & E. I. is shown in one of the illustrations and is usually recommended if the drop table is to go into a shop having floors flush with the tracks.

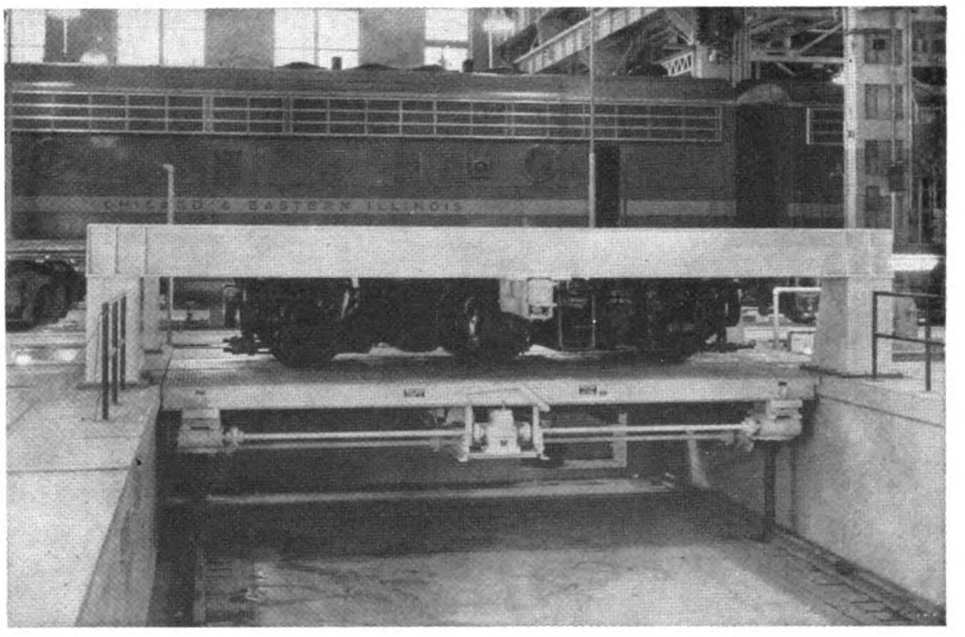
At Harahan, however, it is desirable to have the drop table in the running repair portion of the shop where the floor is depressed 2 ft. 6 in. below the top of the rail and deck level platforms are installed. An open pit would obstruct passage beside a locomotive along the depressed floor level and consequently the arrangement shown in the drawing was worked out.



Cross-section of pit equipped with Consolidated drop table and detachable top as planned for the Harahan, La. shop of the Illinois Central



The Whiting Consolidated drop table being built for the Illinois Central with nested detachable top in place (left) and table alone in elevated position (right)



Consolidated drop table without detachable top, as installed at C. & E. I. diesel shop, Danville, Ill.

A detachable table top, which spans the drop pit at the depressed floor level and carries rails across the pit at active track level, is supported in its upper position by the usual locking bars in abuttment pockets. The top fits snugly on the Consolidated drop table and is made with four round holes large enough to permit passage of the lifting screws when both the drop table and table top are in the lowered position. The vertical projecting hand lever shown in one of the views is used for operating locking bars at both ends of both rails simultaneously.

The top width of the table is 11 ft. 8 in. which permits installation of a post-type body support at the left end of the pit and a girder-type body support on the other side.

The drop table itself is equipped with four wheels and operates transversely in the shallow pit on rails spaced 21 ft. on centers and positioned 5 ft. 9 in. below the depressed floor level. One pair of these wheels is roller-chain driven from a ¾-hp. electric motor suitably mounted under the table. Four large corner screws extend through the drop table and carry saddles at the lower ends which fit over the rail heads, rest in taper positioning blocks and prevent the screws from turning. Table motion vertically is secured by worm-gear drive from a 30-hp. reversible electric motor located under the center of the table. Electricity is supplied through the rubber-covered cable and spring-operated reel, illustrated. Both table lifting and transfer movements are controlled by means of a pendant push button and extension cord which may be plugged in at selected points outside the pit.

The Consolidated drop table in the I. C. installation is not equipped with rails but is of flat, platform-type construction and, when not in actual use, stands at depressed floor level on the right side of the detachable top. In this position the table spans the pit at the depressed floor level, permits men to work around a locomotive and provides uninterrupted passage of men and material across the pit, beneath the deck-level platform.

When a diesel truck is to be dropped, the locomotive is spotted on the detachable top and the truck is disconnected. The platform-type Consolidated drop table is then dropped down onto the pit rails, traversed to a position under the detachable top, raised and nested beneath the top. After projecting the body-support brackets beneath the locomotive jacking pads, the truck is dropped, traversed to the release track in the heavy repair section on the other side of the partition through the shop, raised to repair track level and released.

Due to the nature of work performed on the repair track, there is no objection to the pit being left open in this portion of the shop. A removable chain or pipe guard may be provided if desired.

Advantages of the drop table installation at Harahan may be summarized as follows: (1) Detachable top and drop table both span the pit at depressed floor level; (2) pit in the running repair section completely enclosed and covered, giving plenty of room for men working around the locomotive and for unrestricted, free passage of material; (3) pit kept to a shallow depth; (4) saving in truck release and re-application time with attendant increase in locomotive availability.

This equipment is manufactured by the Whiting Corporation, Harvey, Ill.

Standard Chilled Wheel

Now that the chilled car wheel known as the AARX-1 has become officially accepted and is in production at all plants, it would seem appropriate to examine it anew. Made standard by the AAR effective September 1, 1950, this wheel first attained limited approval in March, 1947. Between these two dates some 400,000 of these wheels were put into service to develop experience both in the foundry and under cars.

This new wheel was designed to improve the flange and rim strength of chilled wheels. Changes in the tread portion *a*, Fig. 1, consisted mainly of an increased thickness of rim *b*, Fig. 1, an increase in the thickness through the throat of flange section of the tread *c*, Fig. 1, and a change in contour and number of brackets under the flange section *d*, Fig. 1. See also Fig. 2.

As originally conceived by the Wheel Design Committee of the Association of Manufacturers of Chilled Car Wheels, the metal necessary to strengthen the tread section of the wheel was obtained by coring out the central

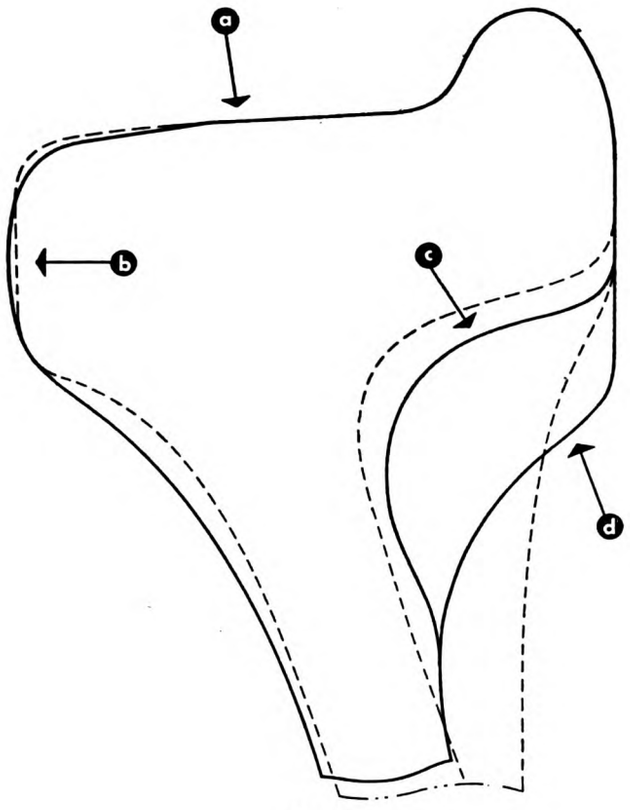


Fig. 1

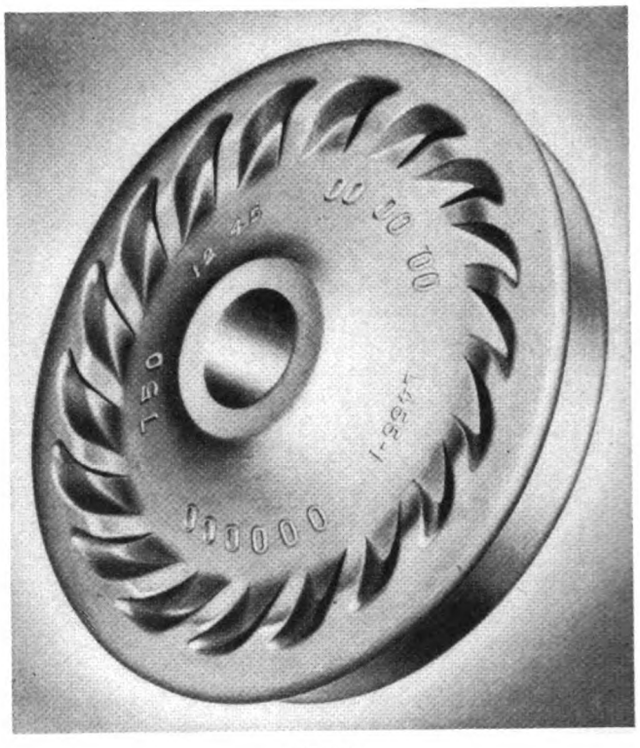


Fig. 2

portion of the hub. Thus, metal was taken from the portion of the wheel where stresses were low and placed where service indicated that stresses were relatively high. Later, the A.A.R. added an approved alternate solid hub design with the same redesigned tread section. Thus, the improvement in the tread area is the outstanding characteristic of the present chilled car wheel.

The thickness of tread through the throat of the flange section has been increased by $\frac{1}{4}$ in. in both the 700 and 750-lb. wheels and by $\frac{5}{16}$ in., to a total of $2\frac{5}{8}$ in. in the 850-lb. wheel. No change was made in the back of flange contour and, as a result, there is no effect whatever on any track clearances.

Laboratory tests on wheels made in this manner as compared to former wheels indicate an average increase in flange strength of approximately twenty per cent. These comparative strengths were obtained by testing different groups of standard and experimental design wheels cast one after the other from the same iron.

The rim thickness of the wheels has been increased but, due to the fact that the contour around the rim has been made more rounded so as to eliminate any semblance of corners, a direct comparison in dimensions is not possible. The rim radius at the tread side was increased from $\frac{5}{8}$ in. to $\frac{3}{4}$ in., while on the underside it was increased from $\frac{5}{8}$ in. to $1\frac{1}{8}$ in. The radius joining the underside of the rim to the plate was also increased and the outer face of the rim made curved instead of straight. The result is a general streamlining of the rim side of the wheel which has been effective in increasing rim strength, and should also reduce the tendency for dirt to be trapped, particularly at the lower corner.

The secondary taper on the tread of the wheel was increased slightly to permit a greater tread wear before a so-called "high rim" developed. This increase amounts to approximately $\frac{1}{16}$ in. at the beginning of the rim radius and, with the increase in this radius, the intensity of impact blows on the rim in service is reduced. In addition, the new design permits a better control of chill depth in this portion of the tread and hence greater resistance to impact blows.

Rim tests made on this design have been conducted in a draft gear testing machine in which a 27,000-lb. weight was dropped one inch onto a striking key which rested on the rim at a distance one inch in from the outer face. The results of these tests show conclusively that the rim of the new wheel stands an average of twice as many blows as the former standard wheel before failure. Later tests in which a 400-lb. weight was dropped five feet to a striking key in the same position produced the same relative results.

The brackets of the new wheel have been made shorter and stockier. They have also been increased in number from 13 to 18, though a maximum of 20 is permissible. The object of this change was to obtain a more uniform support under the flange and also to take care of the possibility that long brackets tend to cause stress concentrations in the wheel plate. The plate itself has been modified to some extent to further improve its resistance to service stresses.

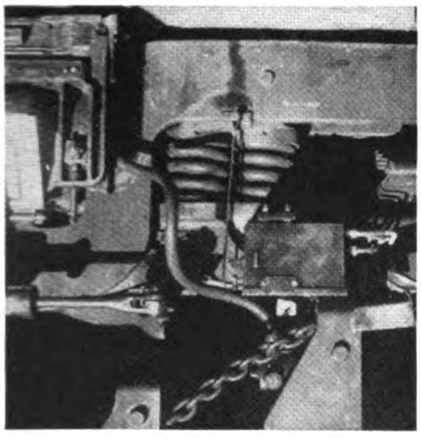
Drop tests made on these wheels have been better than on the previous standard. Numerous thermal tests have been made and, while failures of the previous design were rare, the new wheel shows even greater plate resistance to tread heating.

There has been a very definite improvement in chill control during the past ten years as a result of research on the part of the Wheel Association and its member companies. It was aimed at an increase in the amount of gray iron back of the wear-resistant chill in the wheel tread, while still retaining sufficient chill for maximum tread wear. A combination inoculating treatment added

to the pouring ladle, just prior to its being filled with molten metal, was eventually found to accomplish this purpose and it is now being used at all A.M.C.C.W. wheel foundries as well as some of the others. Although this treatment was used in the previous wheel, it is even more effective in this new design, because tread section is heavier.

It has been definitely proved that wheels having a good backing of gray iron in the tread are stronger, both in the flange and rim, than wheels having a relatively open mottle backing. Specifications on chill applying to these wheels eliminate the possibility of mottle extending through the entire tread section, either at the rim or the flange. This advance in manufacturing methods adds to the improvement in design to give a stronger flange and rim in service.

◆



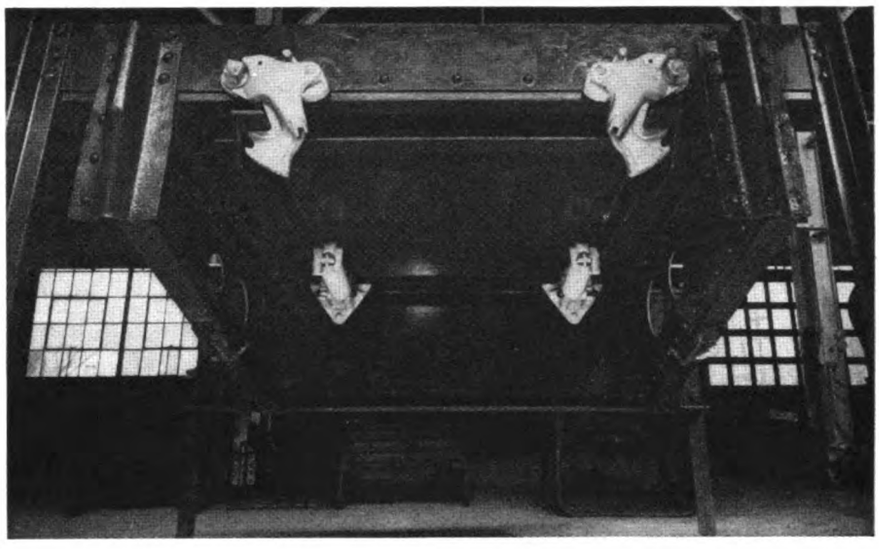
Truck Lubricator

Recently developed and introduced to rail lines is the Type PC railroad truck lubricator made by the Nathan Mfg. Co., New York. This device is designed to permit efficient lubrication of diesel locomotive trucks, particularly of flanges, center plate, spring bearings and other low-pressure points.

The unit consists of a welded steel box which functions as a housing for seven individual pumping units, and as a reservoir for the oil. These pumping units, mounted in a cast iron frame within the housing, are connected to the flanges, spring bearings and center plate by piping, and provide lubrication of these points in proportion to the amount of vertical motion between the truck frame on which the housing is mounted, and the journal box, to which the drive arm of the unit is connected by a flexible strap.

Each series of 20 vertical movements of the journal box in relation to the truck frame, delivers a maximum of 1 cubic centimeter of oil from each of the seven pumping units. This amount may be decreased to zero through separate external adjustment screws for each of the seven units.

This lubricator is of the check-valve type, with a packed piston and spring return stroke. Reservoir capacity is 15½ pints.



Spring Hinge and Adjustable Lock

Designed for all drop-bottom cars of the gondola type with drop doors of any size, the spring hinges make possible one man closure of heaviest doors while the adjustable locks assure uniform door fit by compensating for irregularities in construction and normal warpage during use. The combination maintains individual door operation to suit all lading and unloading conditions.

The hinge relieves the major portion of the door weight from the operator through heavy coil springs operating on variable eccentricity. They are mounted in steel castings to assure free operation.

An eccentric is located in the base of the adjustable latch and allows uniform adjustment between the doors and floor of the car. Difficult operation and loss of lading due to warped doors are avoided.

This hinge and lock combination is made by the Wine Railway Appliance Co., Toledo 9, Ohio.

◆

Heavy Duty Spiral Milling Attachment

Supplementing the improved attachment for the No. 40 standard milling machine, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, is introducing a heavy duty device which, like the smaller unit, is driven from the machine spindle.

This attachment is designed for the larger and more powerful Cincinnati millers, from the No. 3 dial type to the No. 6 dual power dial type units.

It has many features of value for miscellaneous milling operations requiring the cutter spindle adjusted to any angle in the vertical or horizontal planes. Accurately spaced graduations facilitate angular settings.

In order to develop the highest degree of rigidity, the power take-off bracket is clamped to the face of the column and also to the overarm. The spindle and all shafts are mounted on anti-friction bearings; the spindle nose conforms to the No. 50 standard.

◆

Aluminum Alloy Rivets

A new aluminum alloy rivet in the large size range, has been developed by Aluminum Company of America and is offered on an experimental basis for use with heavy duty aluminum structures. The new rivet alloy has been temporarily designated as XB77S. Rivets of this material can be hot driven by hand pneumatic hammers.

In these rivets, Alcoa has provided the following characteristics: an average shear strength of 38,000 p.s.i. within two weeks after driving, a wide temperature range for driving, and good resistance to corrosion when used in recommended applications. The high strength rivet combined with favorable driving characteristics makes possible aluminum applications in bridges and railroad cars. When duplicating those aluminum structures that in the past have been designed using other aluminum alloy rivets, it will be possible now to reduce the bulk and complexity of the joints by using the stronger XB77S rivets.

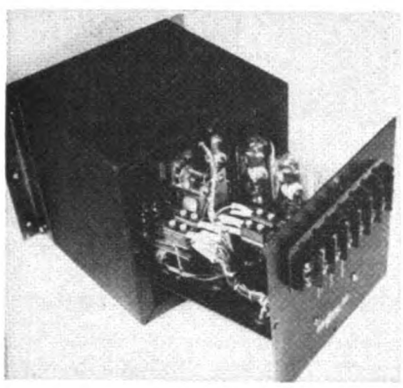
The rivets are available in the ½, ⅝, ¾, ⅞ and 1 inch sizes. When heated within the required temperature range, it is possible to drive each of the above sizes, except the 1 inch, with the proper hand operated pneumatic hammer. When the rivets are squeeze driven, the size range can be extended to include the 1 inch rivet.

The wide heating range, 850-975 deg. F., is advantageous when dealing with field work and is also of importance when shop fabricating aluminum structures. The driving pressure decreases as the temperature is increased within the above-mentioned heating range. In all cases, the required driving pressure depends directly on the rivet temperature at the instant of driving. As is usually the case with hot driven aluminum rivets, the driving pressure for the smaller size rivets is

much more sensitive to any delay between heating and driving than that for the larger sizes.

During preparation for driving, the rivets should be heated in air (never in lead or nitrate) and soaked within the specified temperature range for fifteen minutes. If the heated rivets should fall short of the recommended minimum driving temperature of 850 deg. F., the difficulty of driving will be materially increased. Driving the rivets at temperatures above the upper limit of 975 deg. F. will most likely result in cracked rivet heads.

◆



Caboose Power Load Control Switch

A load control switch for use on axle-driven, generator-battery powered radio-equipped cabooses is now being made by the Gore Company, Denver 1, Colo. It will connect the load to the battery when brake air pressure is applied to the caboose and will keep the load on for four minutes after the train is broken up at terminals. The communication equipment can be turned on for 12-minute intervals in the absence of train line air by pressing a handset button.

When the caboose is entrained and the train line air pressure gets up to 20 lb., the air pressure actuates an air switch which turns on the radio load and keeps it on as long as the air pressure is 20 lb. or more. When the load is first turned on, a series of thermal relays are also started in motion, so that the last one of the sequence shunts the air switch contacts. When the train line pressure drops off, due to a break-in-two on the road, or breaking up the train in terminals, the air switch immediately opens; but the radio load remains on until the breakdown of sequence of the series thermal relays is affected. This breakdown takes 4 minutes, which is adequate time for radio use in the case of train break-in-two or other emergency. As soon as the radio load goes *off*, it is possible to reinstate the radio load immediately merely by depressing a push-to-talk handset switch. In this case, the radio load will be placed in the *on* position for 12 minutes; the time required for both the build up and breakdown sequence of the thermal relays. This operation can be repeated as often as necessary or desired.

The switch reduces battery drain when the caboose is in terminals or switch yards and should serve to prevent damage due to freezing of discharged batteries in terminals, allow the use of smaller lower cost batteries, reduce maintenance and replacement of batteries, and prevent radio outage at start of runs because of discharged batteries.

The switches can be obtained for any voltage system. They have no battery drain when turned off, and use 10 and 12 watts when turned on.

◆

Tester for Transition Relays and Speedometers

New equipment for testing speed-sensitive devices on Alco-G.E. road locomotives has been announced by the General Electric Company. The equipment consists of a portable axle-generator drive unit and a portable tachometer-frequency indicator.

Designed to speed up locomotive maintenance operations and to help insure proper operation of speed-sensitive devices, the test equipment aids in the accurate setting of automatic-transition relays and overspeed relays, and checks the accuracy of speedometers and the sequence of contactors and speed-sensitive relays.

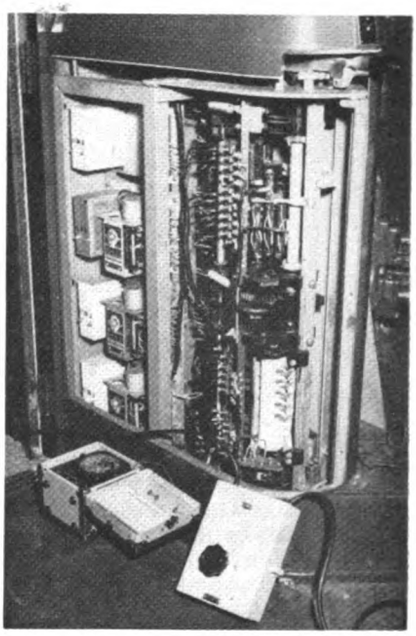
One man can operate the equipment, and the control and meter can be placed next to the equipment being tested.

The portable axle-generator drive drives the locomotive axle generator at controlled speeds, by means of a 75-volt, d.c. motor, a rheostat, a mounting and carrying frame, and leads which connect to the locomotive battery circuit. The mounting frame is designed for attaching the drive unit to generator Models 5GYA3A1 or 5GYA17A1. The drive unit is connected by removing the small end cover from the generator, removing the spline shaft connecting the generator to the axle, and inserting the spline of the drive unit. The unit weighs 60 lb. and is equipped with a carrying handle.

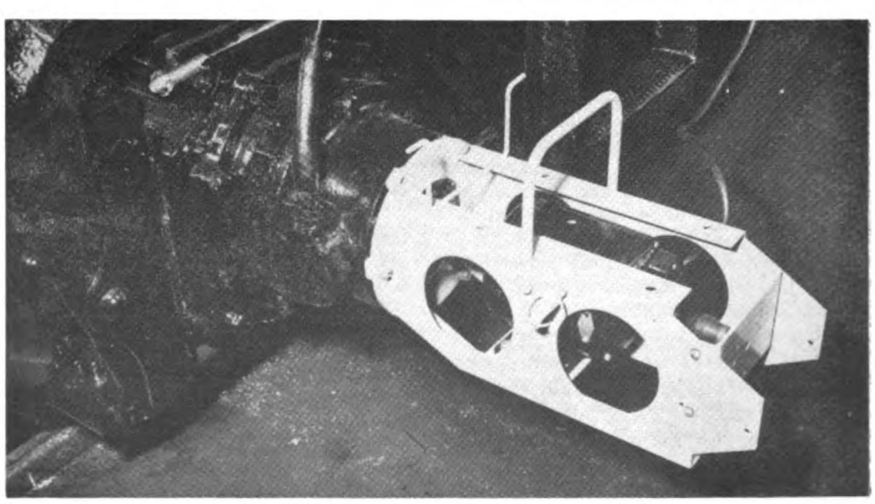
Besides its use with the automatic-transition type axle generator, the drive unit can also be used to drive the small axle-generator (Model 2CM4J7), which operates a speedometer only, when the locomotive is not equipped for automatic transition. In this case, the axle generator is removed from the journal box cover and mounted on the drive unit.

The portable tachometer-frequency indicator is an electric frequency meter which was developed especially for this test equipment. A cycles-per-second scale provides information for accurately setting the automatic-transition relays. The instrument is easily calibrated by means of a switch and calibrating screws, after plugging into a 60-cycle, 115-volt outlet.

A dual-purpose instrument, the tachometer frequency indicator also indicates engine speed by reading the output of the engine tachometers. The unit is adaptable for both old and new locomotives, with or without plug receptacles on the engine control panel.



The portable tachometer-frequency indicator (left foreground) and the portable axle-generator control (right foreground)



The portable axle-generator attached to the locomotive axle

NEWS

Glass Works Establishes Center at Corning

THE Corning Glass Works, Corning, N. Y., at a press conference early in February, announced the establishment of a Glass Center at Corning, N. Y., which will comprise a library and museum collection of the world's glass knowledge where it will be available for research of the industry as a whole. Corning's own facility for research in glass hitherto devoted to the specialized branches of technology embraced by its present laboratory facilities will be considerably augmented by the Glass Center. This project will carry into effect the belief of the company management that industrial research can be broadened effectively to include not only research in scientific aspects of a material, but also in its artistic, historical, philosophical and human relations aspects.

James M. Brown, III, director of the Corning Glass Center, has been director of the William A. Farnsworth Museum in Rockland, Me. The director of the Corning Museum of Glass is Thomas S. Buechner, who came from the Metropolitan Museum of Art.

A.A.R. Mechanical Division Circulars

CONSERVATION OF ZINC IN AB VALVES

To improve the performance of AB brakes during cold weather and thereby eliminate some of the previous difficulties experienced in operating freight trains during winter months, A.A.R. Interchange Rule 60 was modified in the 1951 Code to require the renewal of certain parts of AB valves in all cases where air brakes receive periodic attention and also to provide for the renewal of other parts under certain conditions.

According to a recent A.A.R. Mechanical Division circular, this improvement program will require the air-brake manufacturers to furnish these parts of AB valves in quantities considerably larger than heretofore manufactured for replacement purposes, and this will involve additional consumption of zinc used in their manufacture. Furthermore, there is a likelihood that restrictions will soon be imposed on the consumption of zinc.

Since zinc alloy used in the production of these parts is to a specification which must be maintained, the scrap material derived from old scrap parts is usable to a maximum degree, and the circular urges that these parts be shipped back promptly to the manufacturers for reclamation and reuse of the zinc alloy they contain. The parts of AB valves involved include emergency portion ball check and back covers, service portion back covers, duplex release valve-filling pieces and bodies and quick service limiting valve covers.

DERAILMENTS DUE TO COUPLER KEYS WORKING OUT

A western railroad reports that it experienced three train accidents during 1950, involving main line derailments, as well as several other derailments in train yards, all caused by coupler draft keys working out and allowing couplers to drop between the rails. One of these derailments resulted in the loss of 30 loaded freight cars, as fire broke out because of the accident and could not be controlled.

A.A.R. Interchange Rule 3, Sec. (d) outlines the existing requirements with respect to draft key retainers for cars moving in interchange service, as well as the requirements which are to become effective on January 1, 1952. Sec. (g) of Interchange Rule 18 reads as follows: "When cars are on repair tracks for any purpose, A.A.R. alternate standard, or approved

SELECTED MOTIVE POWER AND PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of October 1950	Month of October 1949	10 months ended with October 1950	10 months ended with October 1949
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	32,308	28,103	288,811	331,233
3-06	Total, Diesel-electric	19,813	13,923	172,503	123,313
3-07	Total, electric	902	680	8,289	7,977
3-04	Total, locomotive-miles	53,035	42,714	469,660	462,544
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,909	1,459	16,229	14,938
4-04	Empty, total	941	728	8,459	8,465
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	56,875	37,541	482,043	520,005
6-02	Total in oil-burning steam locomotive trains	15,257	16,139	128,384	149,671
6-03	Total in Diesel-electric locomotive trains	57,016	39,444	489,918	352,928
6-04	Total in electric locomotive trains	2,493	1,719	22,071	21,414
6-06	Total in all trains	131,695	94,868	1,122,678	1,044,130
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.04	1.05	1.05
10-02	Loaded freight car-miles	40.20	37.80	38.60	36.30
10-03	Empty freight car-miles	19.80	18.90	20.20	20.60
10-04	Total freight car-miles (excluding caboose)	60.00	56.70	158.80	56.90
10-05	Gross ton-miles (excluding locomotive and tender) (000)	2,774	2,460	2,673	2,537
10-06	Net ton-miles (000)	1,307	1,052	1,222	1,140
12	Net ton-miles per loaded car-mile (M-211)	32.50	27.80	31.60	31.40
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	67.00	66.70	65.70	63.80
14	Averages per train hour (M-211):				
14-01	Train miles	16.60	17.20	16.90	16.90
14-02	Gross ton-miles (excluding locomotive and tender) (000)	45,330	41,877	44,526	42,362
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	49.90	39.20	45.20	41.80
14-02	All	47.30	36.50	42.30	39.40
15	Average net ton-miles per freight car-day (000) (M-240)	1,029	678	879	790
17	Per cent of home cars of total freight cars on the line (M-240)	35.60	50.50	41.70	55.40

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000):				
3-05	Steam	11,792	13,367	117,072	157,585
3-06	Diesel-electric	15,476	13,283	145,712	125,699
3-07	Electric	1,623	1,605	16,033	16,542
3-04	Total	28,891	28,254	278,817	299,939
4	Passenger-train car-miles:				
4-08	Total in all locomotive-propelled trains	278,190	269,690	2,686,423	2,808,524
4-09	Total in coal-burning steam locomotive trains	63,050	69,637	604,754	825,497
4-10	Total in oil-burning steam locomotive trains	36,677	39,386	368,966	440,417
4-11	Total in Diesel-electric locomotive trains	160,950	142,862	1,540,161	1,361,666
12	Total car-miles per train-miles	9.45	9.30	9.44	9.18

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,541	1,226	14,230	17,651
1-02	Steam, oil-burning	298	265	1,478	2,761
1-03	Diesel-electric[1]	2,822	2,001	24,839	19,688
1-06	Total	4,692	3,518	41,820	40,363
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	53	73	581	913
2-02	Steam, oil-burning	15	14	134	155
2-03	Diesel-electric[1]	241	217	2,278	2,075
2-06	Total	345	340	3,334	3,494
3	Hours per yard locomotive-day:				
3-01	Steam	9.00	6.40	8.00	8.20
3-02	Diesel-electric	18.10	16.10	17.40	17.20
3-05	Serviceable	15.00	12.60	14.10	13.30
3-06	All locomotives (serviceable, unserviceable and stored)	13.00	9.90	11.90	11.10
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.71	1.69	1.78	1.87
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.77	0.78	0.77	0.77

[1] Excludes B and trailing A units.

equivalent, coupler draft key retainers should be applied in place of non-approved retainers, at car owners expense, whether or not defective. Former A.A.R. Standard T-Type retainers must not be removed unless defective, but should have an approved lock applied, at car owners expense, thus converting it to an A.A.R. alternate standard."

In a recent circular, the Mechanical Division points out that Sec. (d) of Rule 3 was modified on January 1, 1949, and Sec. (g) was added to Rule 18 in the 1950 Code for the express purpose of causing cars to be equipped with improved designs of coupler draft key retainers and thereby eliminate most of the accidents due coupler draft keys working out.

The circular urges strict adherence to this rule and close supervision to assure careful checking of the condition of draft keys and retainers of all cars before departure from terminals.

Air and Smoke Association Appoints Griebling

ROBERT T. GRIEBLING, a fellow of Mellon Institute, has been appointed executive secretary of the Air Pollution and Smoke Prevention Association of America, Inc., Mr. Griebling will be located at the Mellon Institute, Pittsburg, Pa., to where the headquarters of the association will be moved from Chicago.

Union Wants Inspection Of Self-Propelled Cars

THE Brotherhood of Locomotive Firemen & Enginemen has filed a petition with the Interstate Commerce Commission asking that present locomotive inspection rules be extended to include multiple unit cars and similar self-propelled vehicles designed to carry freight or passenger traffic.

A similar petition was filed recently with the commission by the Brotherhood of Locomotive Engineers. In each case, the unions urged the commission to amend a 1925 order in which the I.C.C. eliminated these cars from the definition of the term "locomotive."

The B. of L.F.&E. petition said many railroads operate these units in unsafe condition due, in large part, "to the absence of comprehensive and enforceable rules and instructions for inspection and testing." It asked that each carrier be required to file such rules and instructions with the commission, or that the I.C.C. prepare and prescribe appropriate rules.

I.C.C. Revises Diesel Brake Rule

RULE 205 (a) of the Interstate Commerce Commission's Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam has been revised as proposed in the commission's notice of October 4, 1950. The rule relates to air-brake equipment, and the revised version, prescribed by the commission's Division 3, reads as follows:

"The main reservoir system of each unit shall be equipped with at least one safety valve, the capacity of which shall be sufficient to prevent an accumulation of pressure of more than 10 pounds per square inch above the maximum working air pressure fixed by the chief mechanical officer of the carrier operating the locomotive.

"Each unit that has a pneumatically actuated system of power controls shall be equipped with a separate reservoir of air under pressure to be used for operating such controls, other than brake controls, which reservoir shall be provided with means to automatically prevent loss of pressure in event of failure of main reservoir air pressure, shall have storage capacity to permit not less than 3 complete operating cycles of control equipment and shall be so located that it will not be readily susceptible to damage. Each unit built before January 1, 1951, that has a pneumatically actuated control system of power control shall be so equipped the first time said unit receives repairs of a general nature but not later than January 1, 1952."

The change is the addition of the second paragraph. The first paragraph was the previous rule. The matter was handled by the commission in a proceeding docketed as Ex Parte No. 174, the revision having

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE FEBRUARY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horsepower	Service	Builder
Akron, Canton & Youngstown	3	1,600	Road-switch	Fairbanks-Morse
Chicago & North Western	30	1,500	Road-switch	Electro-Motive
	4	2,250	Passenger	Electro-Motive
	4	1,600	Freight	Alco-G. E.
	5	1,600	Road-switch	Alco-G. E.
	7	1,000	Yard-switch	Alco-G. E.
	6	660	Yard-switch	Alco-G. E.
	2	1,600	Road-switch	Baldwin-Lima-Hamilton
	4	1,200	Yard-switch	Baldwin-Lima-Hamilton
Chicago, St. Paul, Minneapolis & Omaha	6	1,500	Road-switch	Electro-Motive
	4	800	Yard-switch	Electro-Motive
Nashville, Chattanooga & St. Louis	6[1]	1,500	Road	Electro-Motive
	10[1]	1,500	Road-switch	Electro-Motive
	5[1]	1,200	Switch	Electro-Motive
New Orleans Public Belt	2[2]	800	Switch	Baldwin-Lima-Hamilton
New York, New Haven & Hartford	10[3]	2,400	Road-switch	Fairbanks, Morse
Northern Pacific	24[4]	1,500	Passenger	Electro-Motive
	3[4]	1,500	Road-switch	Electro-Motive
Reading	15[5]	1,600	Road-switch	Baldwin-Lima-Hamilton
	15[5]	1,600	Road-switch	Alco-G. E.

STEAM LOCOMOTIVE ORDERS

Road	No. of locos.	Type	Builder
Norfolk & Western	6	2-8-8-2 freight	Company shops

FREIGHT-CAR ORDERS

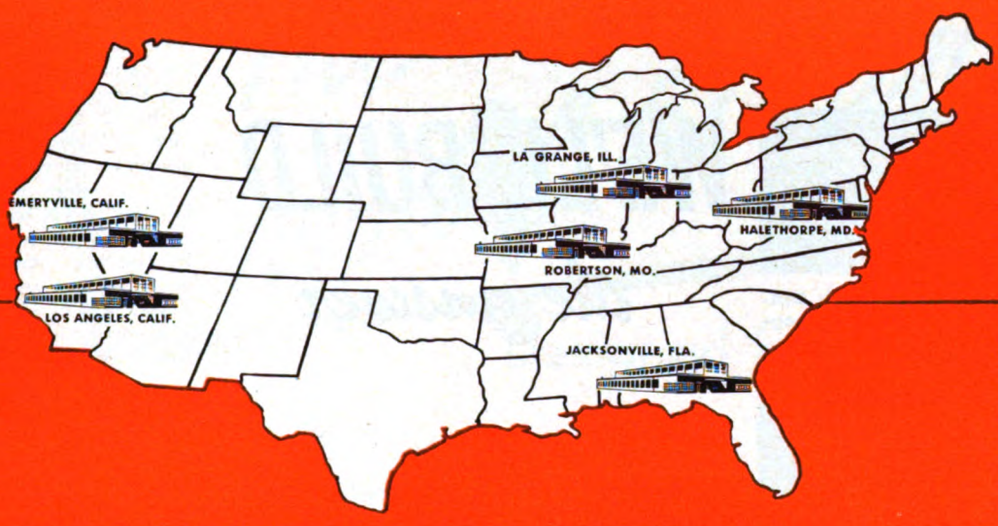
Road	No. of cars	Type of car	Builder
Bangor & Aroostook	500[6]	40-ton refrigerator	Company shops
Buffalo Creek	500[7]	50-ton box	American Car & Fdry.
	500[7]	50-ton box	Pullman-Standard
Canadian National	40	30-ton box	Eastern Car
Chesapeake & Ohio	2,500	70-ton hopper	American Car & Fdry.
	1,000	50-ton box	Pullman-Standard
	750	55-ton box	General American
	200	70-ton covered hopper	Pullman-Standard
	200	70-ton gondola	General American
	250	70-ton flat	Greenville Steel Car
Chicago & Eastern Illinois	300	70-ton hopper	Pressed Steel
	700	50-ton hopper	Pressed Steel
	200	50-ton box	American Car & Fdry.
	300	50-ton box	Company shops
Ford Motor Co.	120	70-ton gondola	Greenville Steel Car
	119	70-ton gondola	Magor Car
Lehigh Valley	350[8]	70-ton gondola	Bethlehem Steel
Louisville & Nashville	3,000	50-ton hopper	Pullman-Standard
	2,200	50-ton box	Pullman-Standard
	300	50-ton box	Pressed Steel Car
	450	Pulpwood	Company shops
Norfolk & Western	3,000[9]	70-ton hopper	Company shops
	500[9]	50-ton box	Pullman-Standard
Norfolk Southern	150	50-ton gondola	Magor Car
Reading	1,000[10]	50-ton hopper	Bethlehem Steel
	1,000[10]	70-ton gondola	Bethlehem Steel
Southern Pacific	1,500	50-ton box	Company shops
Union Pacific	500	40-ton stock	Company shops
	500	70-covered hopper	Company shops

FREIGHT-CAR INQUIRIES

Delaware, Lackawanna & Western	500-1,000	Hopper
Virginia	300	Box

[1] Delivery of the switchers was expected by February 15 and the delivery of the other units by March 15. Acquisition of these units will complete dieselization of the road.
[2] Acquisition of these units will complete the road's dieselization.
[3] To cost approximately $2,225,000. Delivery to be completed this year.
[4] Delivery of road switchers scheduled for March and of the freight locomotives for May and June.
[5] To cost about $4,000,000.
[6] Authorization to acquire these cars at a cost of $500,000 was reported in the February issue.
[7] For delivery in the first quarter of 1952.
[8] To cost approximately $2,300,000. Delivery expected to be completed early in 1952.
[9] Delivery of the hopper cars expected to begin in the last quarter of 1951. Delivery of the box cars expected to begin next December.
[10] Gondolas to cost $6,170,000; hoppers, $4,875,000.

NOTES:
Erie.—The board of directors of the Erie has authorized the purchase of 500 box and 500 mill-type gondola cars.



81% of all General Motors locomotives in the United States are operated by railroads with Electro-Motive factory branches *on their lines.*

Strategic location of production-line rebuilding facilities saves money for our customers and cuts out-of-service time. Compare EMD flat-rate overhaul charges with your present costs and see for yourself.

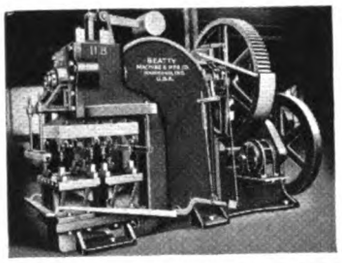
GM DIESELS ARE THE BEST RAILROAD SECURITY

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS GENERAL MOTORS LOCOMOTIVES LA GRANGE, ILL

Home of the Diesel Locomotive

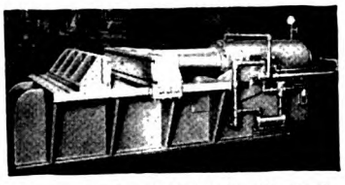
In Canada: GENERAL MOTORS DIESEL, LTD., London, Ont.



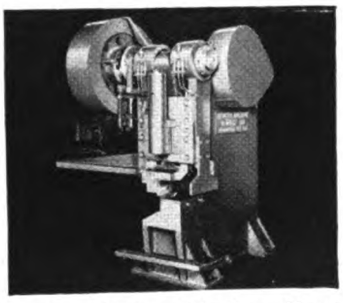
BEATTY No. 11-B Heavy Duty Punch widely used in railroad industry.

YOU NAME the problem

WE'LL BUILD the answer



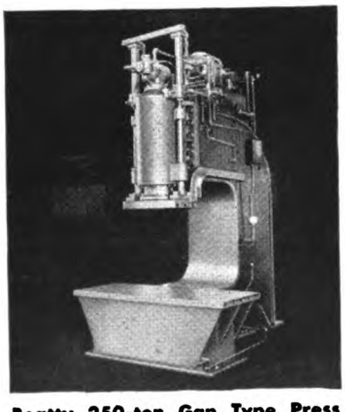
Beatty Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.



Beatty Single End Bar Shear available in capacities up to 300 ton.

If you have a heavy metal working problem, the odds are that a BEATTY engineer can provide the answer. That's true because BEATTY engineers have designed and built so many special machines that no problem is completely new to them.

Our experience in many fields qualifies us to design and build heavy metal working tools that will speed your production, reduce your fabricating costs. There is a better way to handle most production problems, and our specialty is to help you find that better way.



Beatty 250-ton Gap Type Press for forming, bending, flanging, pressing.



HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

been recommended by Edward H. Davidson, director of the Bureau of Locomotive Inspection Division 3's order prescribing the new rule was dated January 29. It noted that no objection to the change was filed pursuant to the notice of October 4, 1950. (See page 701 November 1950, *Railway Mechanical and Electrical Engineer.*

Miscellaneous Publications

VAPOR STEAM GENERATOR.—Vapor Heating Corporation, Railway Exchange building, Chicago. Bulletin 1213. 38 pages, 8½ in. by 11 in., illustrated. Covers performance of Vapor steam generators in diesel locomotive service with particular reference to severe cold weather operation. Includes papers on new features of engineering design, periodic maintenance, water treatment, and a stenographic report of an all-day conference, sponsored by Vapor, held at Chicago on September 21, 1950, and attended by diesel representatives from 45 railroads.

POWER TO STOP.—American Steel Foundries, 400 North Michigan Avenue, Chicago 11. 16-page bulletin. Summarizes a 16 mm. color sound moving picture of the same title recently released for showing to railroad clubs and car foremen's associations. Film illustrates the energy involved in stopping passenger trains from high speeds and shows the effectiveness with which Simplex unit-cylinder clasp brakes operate under all conditions. Laboratory test equipment and road-test car are also featured in the bulletin as well as in the film, and test results summarized.

SUPPLY TRADE NOTES

TENNESSEE COAL, IRON & RAILROAD CO.—*Robert Gregg* has retired as president of the Tennessee Coal, Iron & Railroad Co., a subsidiary of the United States Steel Corporation, and has been succeeded by *Arthur V. Wiebel*, formerly vice-president in charge of operations.

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LUMINATOR, INC.—*E. Z. Zimmerman* has been appointed associate design engineer of Luminator, Inc.

◆

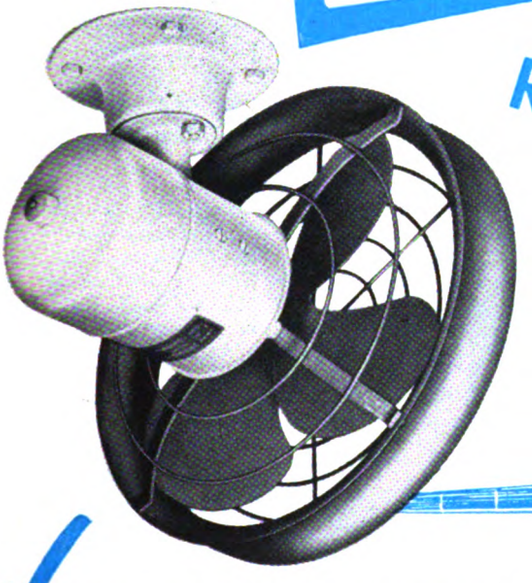
AIR REDUCTION COMPANY.—The Air Reduction Sales Company, a division of the Air Reduction Company, 60 East 42nd street, New York 17, has recently completed a 16 mm. two reel sound motion picture which tells the story of the new Aircomatic process for welding aluminum, stainless steel, bronzes and Monel. The film explains the nature, character and uses of the process, with close-up photography of the Aircomatic arc. It is designed



INTRODUCING

The Safety "Model 51" Fan

Designed for the Railroads of Tomorrow



Totally enclosed, dustproof motor . . . cover easily removable for internal inspection.

Aerodynamically correct venturi ring assures maximum air delivery.



Base-located plug and receptacle allow instant motor removal from line without breaking connections.

Swivel mounting arrangement permits adjustment of fan for any desired air direction.

4-blade, 12-inch diameter fan unit now available to the following specifications:

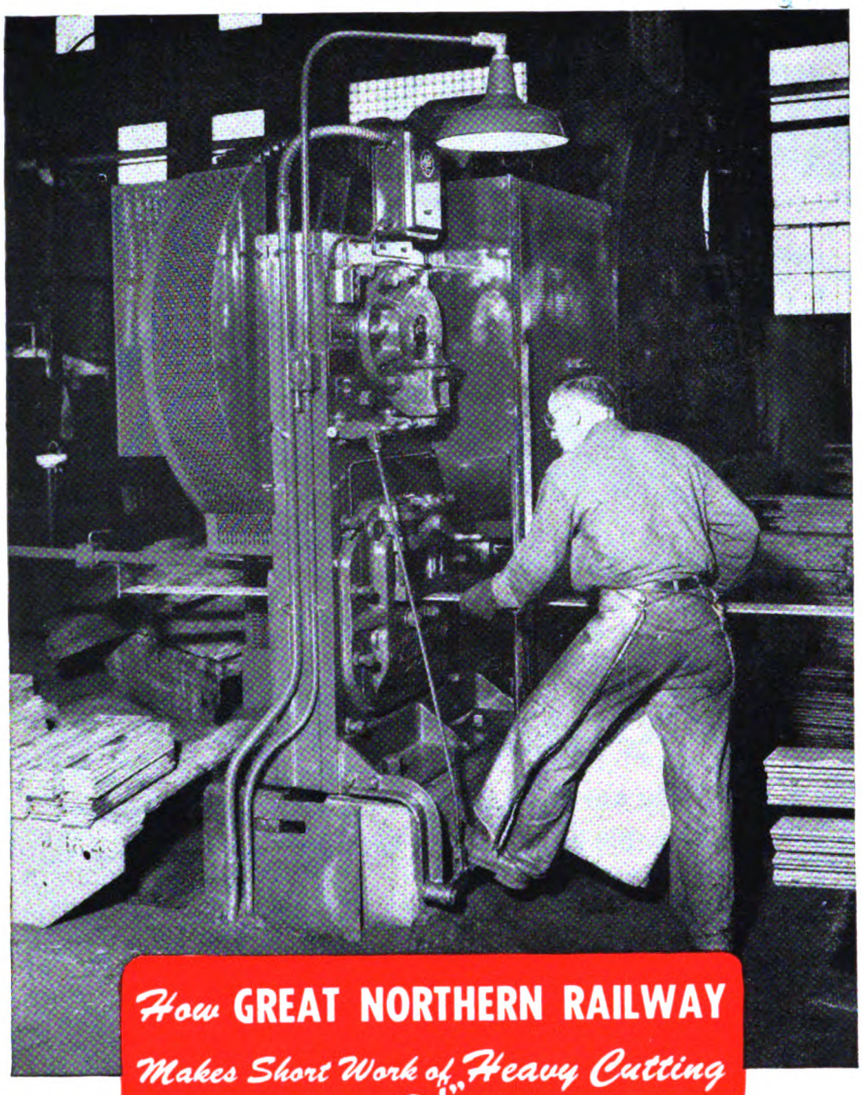
Catalog No.	Volts	Amps.	Air Delivery CFM	Fan Speed RPM
91290	32 DC	.93	2550	1780
91390	64 DC	.47	2550	1780
*90749	110 DC	.42	2550	1780
	110 AC-25 Cycle	.515	1740	1225

*This fan has universal motor.

THE SAFETY CAR HEATING AND LIGHTING COMPANY INC.

NEW YORK · CHICAGO · PHILADELPHIA · ST. LOUIS · SAN FRANCISCO · NEW HAVEN · MONTREAL

SAFETY COMPANY PRODUCTS INCLUDE: Complete Air-Conditioning Equipment • Genemotors • Generators • Fans Regulators • Lighting Fixtures • Switchboards • Parcel Racks • Generator Drives • Motor Alternators •



How GREAT NORTHERN RAILWAY
Makes Short Work of Heavy Cutting
—using this "Buffalo" BILLET SHEAR

Efficient maintenance is one of the reasons why Great Northern "keeps 'em rolling" so well. The "Buffalo" No. 9 Billet Shear above, in their St. Paul shops, helps speed this maintenance. Here it is making short work of cutting ⅜" x 4" spring leaf for caboose springs. It's also used for cutting rounds, flats and angles. Note the clean cuts. 10 other sizes are ready to speed up any cutting job you may have, up to 10" rounds. WRITE FOR BULLETIN 3295-A for complete details.



BUFFALO FORGE COMPANY
174 Mortimer St. Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Branch Offices in all Principal Cities

DRILLING PUNCHING CUTTING SHEARING BENDING

for presentation before non-technical as well as technical groups, who may make arrangements for its showing by communicating with Air Reduction. The film, entitled "The Tool for the Job," has a running time of 21 min.

◆

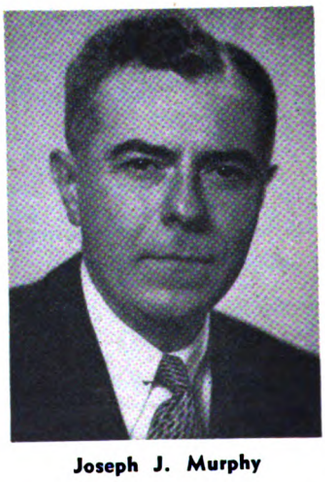
MacLean-Fogg Lock Nut Company.—As reported in the February issue, 1950, *Railway Age, Ernest G. Doke* and *Joseph J. Murphy* have been appointed vice-presidents of the Mac Lean-Fogg Lock Nut



Ernest G. Doke

Company. Mr. Doke, a graduate of Purdue University in 1937, was employed by the Chicago Hutchins Corporation and the U. S. Gypsum Company prior to his association with MacLean-Fogg. He joined that company in February, 1940, as an engineer, and in April, 1943, became assistant to the president.

Mr. Murphy was born in Chicago and is a graduate of Dartmouth (1925). Pre-

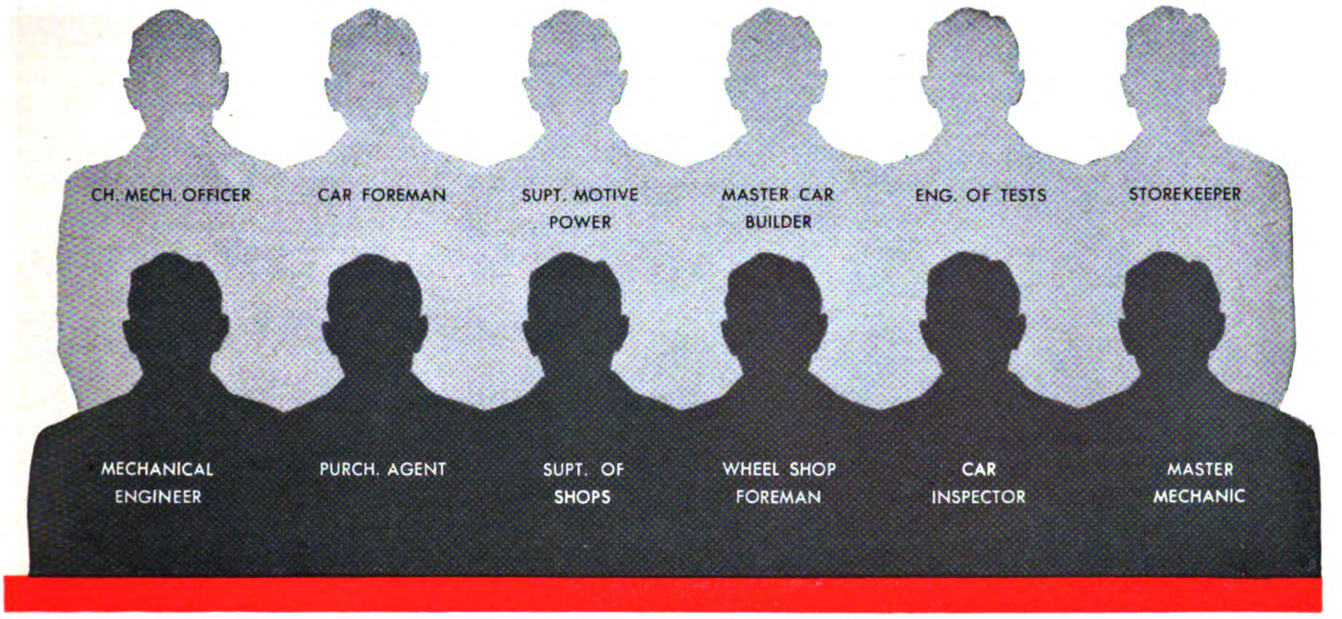


Joseph J. Murphy

vious to joining MacLean-Fogg he as in the investment business and with the J. W. Mortell Company. In 1943 he became associated with MacLean-Fogg as a salesman. He was appointed sales manager in 1947.

◆

Kennametal Inc.—*John C. Redmond*, formerly research director, has been elected vice-president in charge of metallurgical development of Kennametal Inc., Latrobe, Pa. *Bennett Burgoon, Jr.*, has been appointed assistant to the general sales manager. *Gilbert Bunn*, manager of the Philadelphia-New York district, succeeds



gentlemen of the jury ...do you have all the evidence?

Before you reach firm conclusions regarding the values of chilled car wheels, *be sure you know all the facts*.

Call the witnesses . . .

SAFETY ENGINEER: "The safety record of the AMCCW wheel, considering all factors, is now unsurpassed in freight car service. The latest AMCCW design continues the trend toward even greater trouble-free mileage."

EFFICIENCY EXPERT: "The AMCCW wheel offers lower resistance to rolling and minimum abrasion to the rail. It also offers greater efficiency in brake shoe friction, yet shows less brake shoe wear per unit of retardation."

METALLURGIST: "The AMCCW chilled car wheel requires no work-hardening in service. Consequently there is no flow of tread metal. And the damping property of gray iron in the plate and hub of this wheel reduces axle shock."

MACHINIST: "You can bore AMCCW chilled car wheels faster, with less wear on cutting tools. And the elasticity of iron permits a tighter fit to the axle."

For more complete information about the advantages of AMCCW chilled car wheels, send for the new booklet: GENTLEMEN OF THE JURY.



Now, more brackets—thicker, heavier, more continuous flange support; heavier tread on both rim and flange sides.

AMCCW

Low first cost
Low exchange rates
Reduced inventory
Short haul delivery
Increased ton mileage
High safety standards
Complete AMCCW inspection
Easier shop handling

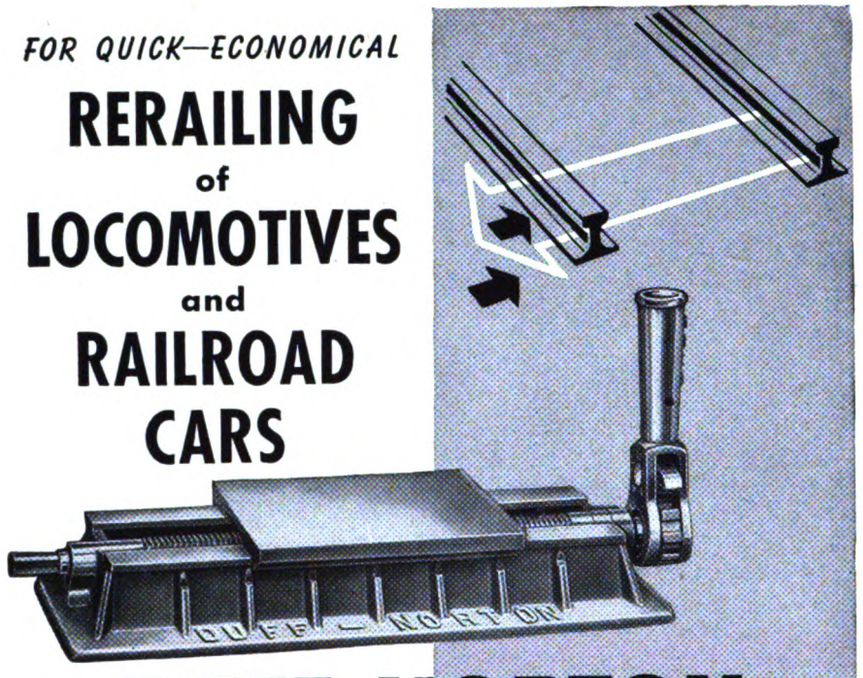
ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 North Sacramento Boulevard, Chicago 12, Ill.

American Car & Foundry Co. • Southern Wheel (American Brake Shoe Co.)
Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co.

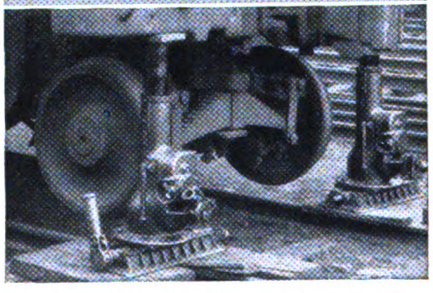
FOR QUICK—ECONOMICAL

RERAILING of LOCOMOTIVES and RAILROAD CARS



DUFF-NORTON *TRAVERSING BASES*

Emergency rerailing of Diesel, steam, electric locomotives and railroad cars . . . is safe, simple and low in cost, with Duff-Norton Traversing Bases. Carried on wreck trains in units of two bases and two jacks, they eliminate the need for expensive cranes and are always available for any rerailing job.



Traversing Bases and Jacks are placed under load. for rerailing locomotives and cars.

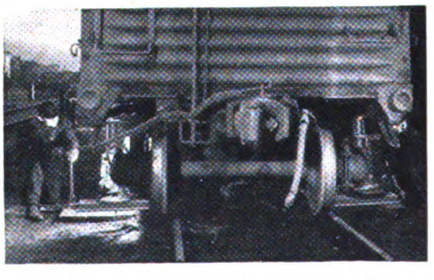
QUICK DATA ON TRAVERSING BASES

Jack No.	Capacity Tons	Height Inches	Horizontal Travel Inches	Weight Pounds	Size of Plate Inches
39-TB	35	3¾	15	85	12 dia.
*40-TB	50	4	15	106	10 x 12
41-TB	50-75	4	20	140	14 dia.

*No. 40-TB can also be furnished for 26" horizontal movement on special order.

No. 40-TB furnished with wooden operating lever 1 1/16" x 24" long.

Nos. 39-TB and 41-TB supplied with steel operating lever 1" x 24" long.



Freight car is lifted and moved horizontally until wheels are aligned with rails. Jacks are lowered to complete rerailing job.

For Jacks Used With Traversing Bases . . .
Write for Your Copy of Bulletin AD-4-R.

DUFF-NORTON JACKS — STRENGTH, SAFETY, DURABILITY — ESTABLISHED 1883

THE DUFF-NORTON MANUFACTURING CO.

Main Plant and General Offices, PITTSBURGH 30, PA. Canadian Plant, TORONTO 6, ONT.

"The House that Jacks Built"

Mr. Burgoon as manager of the Detroit-Cleveland district. *Douglas C. Cunningham*, formerly representative in the Detroit district, has been appointed manager in the Philadelphia-New York district.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*Edward A. Boshell* has been elected chairman and president of the Westinghouse Air Brake Company and its subsidiary, the Union Switch & Signal Co., to succeed *A. N. Williams*, president of both companies since 1946. Mr. Williams has been elected vice-chairman of the two organizations.

Mr. Boshell was born in Melvin, Ill. He is a graduate of Culver Military Academy (1919) and of the University of Illinois School of Commerce (1923). He received an LL.B. from the latter institution's College of Law in 1926. In the same year he was admitted to the bar in Illinois and became associated with the law firm of Knapp & Campbell in Chicago. In 1928 he became assistant general attorney for the Consolidated Electric & Gas Co. of Chicago and New York. In 1933 he joined the Stone & Webster Service Corp. as attorney. He became vice-president in charge of finance of Stone & Webster in 1938 and held that office until becoming associated with Standard Gas & Electric Co., New York, ten years later. He has been chairman and president of Standard Gas & Electric and the affiliated Philadelphia Company, Pittsburgh, Pa., since 1948, and will continue in a consultative and advisory capacity to the utility organization. Mr. Boshell has been associated also with the Duquesne Light Company for the past three years.



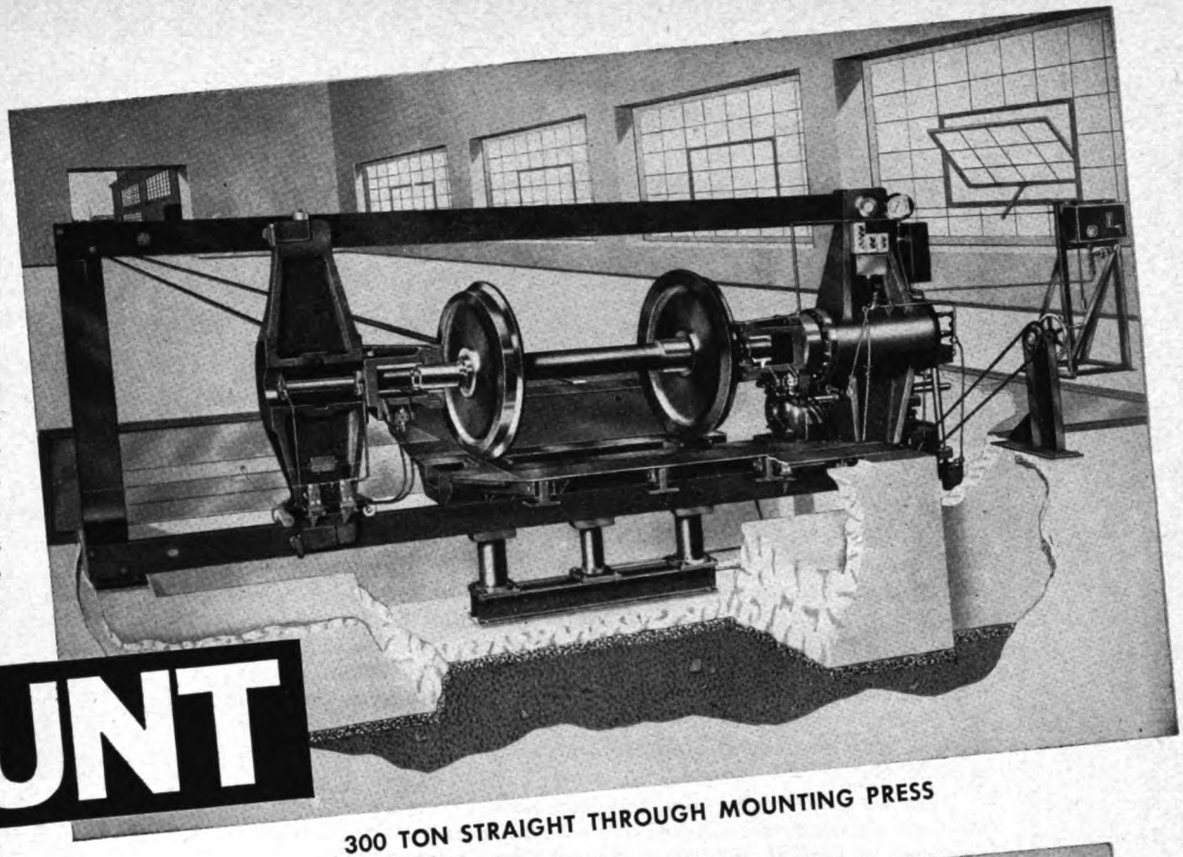
E. A. Boshell

◆

AMERICAN LOCOMOTIVE COMPANY.—The American Locomotive Company has established a new organization at its Schenectady, N. Y., plant to handle ordnance production while continuing intact its organization for manufacturing diesel-electric locomotives. Railroad customers have been assured, in a policy letter from Duncan W. Fraser, Alco chairman and president, that Alco-General Electric locomotives and parts will continue to be produced at capacity levels and that commitments on deliveries would be met just as in the past, unless national conditions affecting all builders interfere. *A. M.*

Now, ALL Railroads can put wheel mounting and demounting operations on a real production basis with new, modern W-S Wheel Mounting and Demounting Presses.

Incorporating outstanding design and construction features, these latest developments of W-S Engineers provide the fastest cycle of operation ever attained in this type of equipment, and they handle any type of wheels.



300 TON STRAIGHT THROUGH MOUNTING PRESS

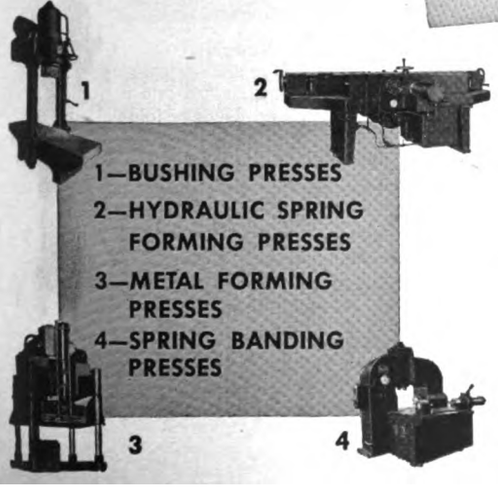
MOUNT and DEMOUNT in Seconds with NEW W-S WHEEL PRESSES

Smashing time records daily, these New Watson-Stillman Speed Presses permit YOU to set your own floor-to-floor speed time—and this is only limited by your loading and unloading facilities.

Get the story today from one of the W-S Representatives listed below.



600 TON STRAIGHT THROUGH DEMOUNTING PRESS



1—BUSHING PRESSES
2—HYDRAULIC SPRING FORMING PRESSES
3—METAL FORMING PRESSES
4—SPRING BANDING PRESSES

WATSON-STILLMAN

HYDRAULIC MACHINERY DIVISION ESTABLISHED 1848

Factory and Main Office: ROSELLE, NEW JERSEY • Branch Office: CHICAGO, ILL.

Manufactured in Canada by CANADIAN VICKERS, Ltd., MONTREAL

REPRESENTATIVES

Chicago 4, Ill. ..... W. R. Walsh	St. Paul 4, Minn. ..... Anderson Machine Tool Co.
Denver 2, Colo. ..... Overgard Machine Tool Co.	San Francisco 5, Calif. ..... Overland Supply Co.
New York 17, N. Y. ..... Eastern Railway Supplies, Inc.	Washington 5, D. C. ..... Ralph Payne

Now Available

NEW CLASS H* MOTORS PROTECTED BY DOW CORNING SILICONES

. . . the insulation that has already saved industry millions of maintenance dollars plus the hourly output of hundreds of thousands of men!

This most timely announcement caps the test program we started 8 years ago when silicone resins were introduced by Dow Corning Corporation. First we proved by accelerated life testing that silicone insulated motors had a good 10 to 1 advantage in life expectancy and wet insulation resistance. Then we sold silicone (Class H) insulation to the manufacturers of electrical equipment ranging from lift truck and traction motors to solenoid and brake coils. We also encouraged the better rewind shops to rebuild hard working industrial motors with Class H insulation.

Now we can proudly refer American industry to this goodly list of electrical manufacturers, all able and willing to supply electric machines protected by Class H insulation made with Dow Corning Silicones.

Take your special problems to the application engineer representing any of these companies or to our Product Development Engineers.

furnished by:

ALLIS-CHALMERS MANUFACTURING COMPANY
The Leland Electric Co
Continental Electric Co., Inc.
THE LOUIS ALLIS CO.
ELECTRO DYNAMIC
The Reliance Electric & Engineering Company
ELLIOTT COMPANY
THE B-A-WESCHE ELECTRIC COMPANY
KURZ & ROOT COMPANY
WESTINGHOUSE ELECTRIC CORPORATION
THE MASTER ELECTRIC COMPANY

* "Class H" insulation is the kind of insulation that keeps motors running in spite of "Hell and High water." (slanguage dictionary)

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
DOW CORNING SILICONES

Atlanta • Chicago • Cleveland • Dallas • Los Angeles • New York • Washington, D. C.
In Canada: Fiberglas Canada Ltd., Toronto • In Great Britain: Midland Silicones, Ltd.

Hamilton, vice-president, is in charge of the new Ordnance division, and *W. E. Corrigan*, another vice-president, has been appointed contracting officer of the division.

◆

VAPOR HEATING CORPORATION.—*Stephen Sarnecke* has been transferred from the Chicago headquarters of the Vapor Heating Corporation to Atlanta, Ga., to work with railroads in Georgia, Tennessee, Alabama and the Carolinas. Mr. Sarnecke has been with Vapor for several years in development engineering and has worked with railroads all over the country on train-heating problems.



Stephen Sarnecke

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY.—As reported in the February issue, *J. E. Vaughn* has been appointed vice-president in charge of all sales of the Standard Railway Equipment Manufacturing Company and its subsidiaries, with direct supervision over all the sades offices.

Mr. Vaughn was born at St. Louis, Mo., and attended St. Louis University. He has been associated with Standard and a predecessor for 27 years, having joined the P. H. Murphy Company at New Kensington, Pa., in 1923. He was serving as chief shop inspector at New Kensington in 1929 when he was transferred to Chicago to become sales service engineer. In 1937 he was appointed assistant to the vice-president of Standard Railway Equipment at



J. E. Vaughn



"YOU BUY 1 BOX . . . OR 10,000 BOXES . . . AT THE SAME LOW FLAT PRICE PER BRUSH!"

BECAUSE WE'VE STANDARDIZED NATIONAL TRADE-MARK CARBON BRUSHES

FOR DIESEL-ELECTRIC LOCOMOTIVE EQUIPMENT!

YOU PAY the same low, flat price regardless of how many brushes you buy, providing you buy one box or multiple thereof. You get fast delivery because these brushes are kept in stock in large supply. You get better quality because of manufacturing refinements made possible by mass production economies. You get a brand new package — sturdy, attractive, easy to store and handle.

Why is this possible? Because we have STANDARDIZED "NATIONAL" brushes for all motors and generators commonly used on diesel-electric locomotives. We have picked the best brushes in the field for dependable operation under severe and varying conditions. We have made them with top performance grades and still stronger connections — made them better in many ways — and we are now making these brushes in quantity. The list of STANDARDIZED diesel-electric brushes follows:

BRUSH NO.	SIZE (INCHES)	GRADE
	FOR TRACTION MOTORS	
NC 24-7215	2 x 2¼ x ¾ (⅜-⅜)	"Plytek" Grade AZY
NC 24-7213	2 x 2¼ x ¾ (⅜-⅜)	"Plytek" Grade AX-5
NC 24-5620	2 x 1¾ x ¾ (⅜-⅜)	"Plytek" Grade AZY
NC 24-5619	2 x 1¾ x ¾	Grade AX-5
NC 20-6420	2⅛ x 2 x ⅝ (5/16-5/16)	"Plytek" Grade AZY
NC 20-6419	2⅛ x 2 x ⅝ (5/16-5/16)	"Plytek" Grade AJH
NC 32-5204	2¼ x 1⅝ x 1	Grade AX-5
	FOR MAIN GENERATORS	
NC 24-4024	2½ x 1¼ x ¾ (⅜-⅜)	"Plytek" Grade 255
NC 24-4009	2½ x 1¼ x ¾ (⅜-⅜)	"Plytek" Grade SA-45
NC 12-4819	2¼ x 1½ x ⅜	Grade SA-35 (30/30 Bevel)
NC 20-4202	2 9/16 x 1 5/16 x ⅝ (5/16-5/16)	"Plytek" Grade SA-3590
NC 20-5633	2¼ x 1¾ x ⅝ (5/16-5/16)	"Plytek" Grade SA-3590
NC 12-4812		
NC 12-4813	2¼ x 1½ x ⅜	Grade SA-35 (35/10 & 35/30 Bevels)
NC 13-5101	2¼ x 1.580 x .400	Grade AX-5
	FOR AUXILIARY EQUIPMENT	
NC 20-3220	2 x 1 x ⅝	Grade 259
NC 16-3220	1¾ x 1 x ½	Grade SA-3538
NC 16-5622	1¾ x 1¾ x ½	Grade 259
NC 08-3216	1¾ x 1 x ¼	Grade SA-45

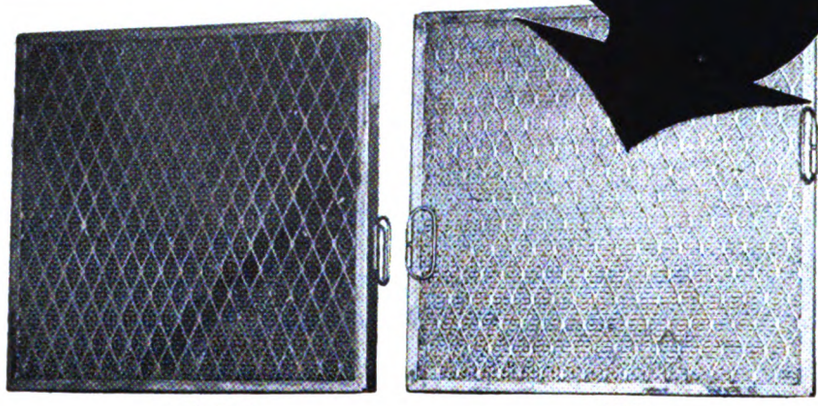
The term "National" is a registered trade-mark of

NATIONAL CARBON COMPANY • **Division of Union Carbide and Carbon Corporation**

30 EAST 42ND STREET, NEW YORK 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco • In Canada: National Carbon Limited, Toronto 4

18 Filters (20"x 22"x 2¼") Cleaned—Rinsed—Oiled in Less than 5 Minutes!



BEFORE AFTER

When you use the Magnus Filter Cleaning Method, individual handling of separate filters through the operations of cleaning, rinsing, oiling and drying is eliminated. As a result, 18 large filters (20" x 22" x 2¼") or 36 small filters (9" x 20" x 2¼") can be cleaned, rinsed and oiled simultaneously in less than 5 minutes!

The dirty filters are loaded in baskets, agitated for 1 to 2 minutes in the Magnus Aja-Dip Cleaning Machine where they are cleaned, corner to corner, of all dirt and clogging deposits. The basket of filters is then agitated for 1 minute in the Magnus Aja-Dip Rinsing Machine followed by a 1-minute dip in the Magnus Hot Oil Tank . . . total—less than 5 minutes. The filters are then dried in the Magnus Dryer.

Filter Cleaning by the Magnus Method is far better than is obtainable with steam gun, sprayer or geyser type equipment. Best of all, labor costs for the job are reduced to the part-time wages of one unskilled worker. Initial equipment cost is surprisingly low.

Ask for complete information on Magnus Filter Cleaning Equipment.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

MAGNUS CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

New York. *He* returned to Chicago in 1938, and in 1943 became assistant vice-president of the company. He was appointed a vice-president of Standard in 1945, and vice-president of the parent company, Standard Railway Equipment Manufacturing Company, in 1947.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*Herbert L. Mausk* has been elected vice-president, sales, railway division of the National Malleable & Steel Castings Co., and *Ellsworth H. Sherwood* has been elected assistant vice-president, sales, railway division.

Mr. Mausk began his career with National in 1908 as office boy. He advanced



Herbert L. Mausk

steadily through engineering and railway sales positions until his appointment as general manager of sales, railway division, which position he has held for the last five years.

Mr. Sherwood joined the Cleveland (Ohio) works of National in 1920. He



Ellsworth H. Sherwood

worked in various sales capacities until his appointment as manager of sales, railway division, at New York, in which position he was serving at the time he was elected assistant vice-president, sales.

◆

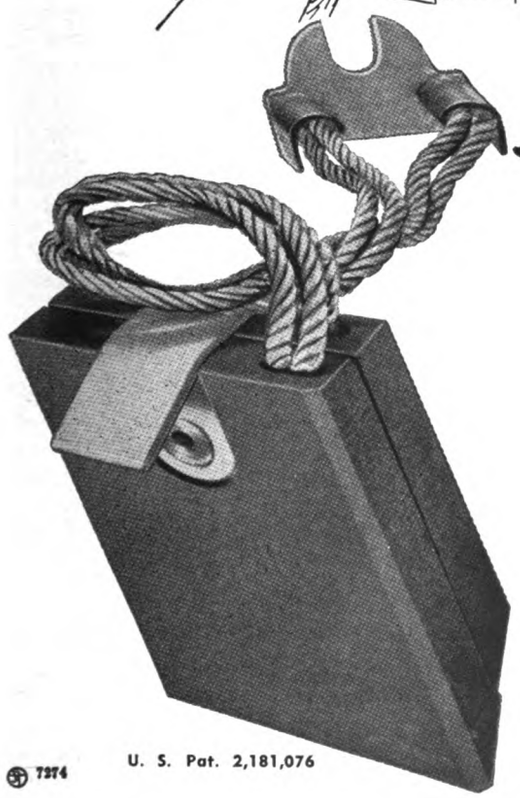
AMERICAN LOCOMOTIVE COMPANY.—*Joseph W. S. Davis* has been appointed assistant to W. A. Callison, vice-president, eastern regional sales, of the American Locomotive Company, with headquarters at the company's New York office. Mr. Davis has been assigned responsibility



Tops

LIKE SPEER MULTIFLEX BRUSHES

For Better Contact



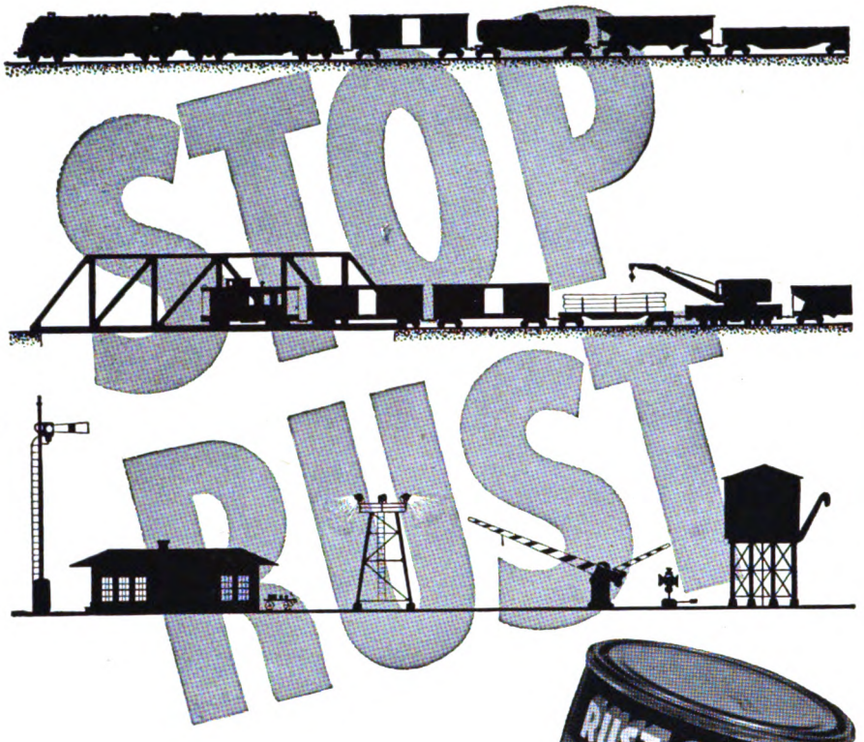
SPEER Carbon CO.

ST. MARYS, PENNSYLVANIA

Subsidiaries

Speer Resistor Corp. – International Graphite & Electrode Corp.
Jeffers Electronics, Inc.

7374 U. S. Pat. 2,181,076





Save Hard-to-Get Metals!

If They're Rustable...

You Need

RUST-OLEUM

Always a needless waste—rust is a doubly dangerous enemy now when it is difficult to obtain metal replacements. Stop the ravages of rust with RUST-OLEUM—an effective, practical means of *rust control.* RUST-OLEUM'S tough, pliable, rust-resisting film provides excellent protection to rolling stock, metal buildings, tanks, signal equipment and other railroad properties.

Proved in Railroad Use — from Coast to Coast

On major railroads, RUST-OLEUM stops rust — easily, effectively, economically and extends the useful life of all rustable metal surfaces. Applied by brush, dip, or spray, it saves time and labor on application... It can be applied *even* over metal that is already rusted. It is necessary to remove only the rust scale and loose rust with a sharp scraper and wire brush. It's the practical answer to effective rust prevention by field maintainers.



Write today for RUST-OLEUM'S new catalog of railroad applications... and give us the details of any troublesome rust problems you may have.

AVAILABLE IN COLORS, AND ALUMINUM.



"Rigid Economy, Mon!"

RUST-OLEUM CORPORATION

2591 Oakton Street **Evanston, Illinois**

for sales of the Railway Steel-Spring Division in the entire eastern seaboard area.

Mr. Davis has been associated with the Railway Steel-Spring Division of American Locomotive since 1930, and since 1945 has been assistant district sales manager in the New York district, which recently was incorporated into the eastern regional sales organization.

◆

UNION ASBESTOS & RUBBER CO.—*John S. Lundvall* has been elected vice-president in charge of the Equipment Specialties division of the Union Asbestos & Rubber Co.

Mr. Lundvall was born at Davenport, Iowa, and is a graduate of that city's high school (1922). For several years he was employed as a draftsman at the Davenport



John S. Lundvall

Locomotive Works, subsequently moving to Chicago. He attended night classes at Lewis Institute and was associated with Harry Vissering and the Okadee Co. prior to joining the Equipment Specialties Company, which Union Asbestos & Rubber acquired in 1936 and established as a division. Mr. Lundvall has been in charge of the division since 1945.

◆

K-G EQUIPMENT COMPANY.—*Chester F. Delbridge* has been appointed general sales manager of the K-G Equipment Company, formerly the K-G Welding &



Chester F. Delbridge

Cutting Co. He will maintain headquarters at 50 Broadway, New York 4, the executive sales office of the company. Mr.

How "Roller Freight" will cut your operating costs...*all along the line!*



AT TERMINALS

90% fewer man hours are needed for terminal inspection when freight trains are mounted on Timken® tapered roller bearings!



IN THE YARDS

"Roller Freight" makes more cars available because cars get where they're going faster and spend less time in repair shops. Humping operations cannot displace Timken journal bearing parts.



IN THE SHOP

Timken bearings cut repair bills by reducing wear on draft gear and other parts. Impact damage from "serial starting" jolts can be eliminated.



AT DESTINATIONS

"Roller Freight" reduces lading damage claims by making smoother starts and stops possible. Timken bearings cut starting resistance 88%.



ON THE ROAD

Timken bearings practically eliminate "hot boxes" and the resulting expense and delays. Roller bearing design minimizes friction, permits better retention of lubricants. And there's no waste to "grab."

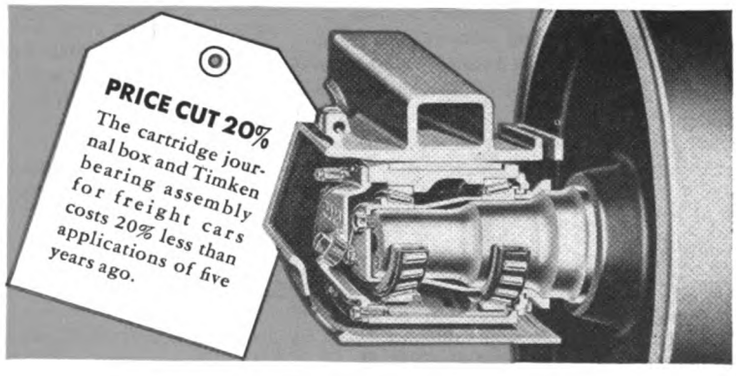


ANYWHERE

Timken bearings reduce starting friction to a minimum. You can schedule full-length trains even in cold weather.

"Roller Freight" will go far in cutting your operating costs. And it will give you a big advantage with shippers when you're bidding for a greater share of tomorrow's freight tonnage. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

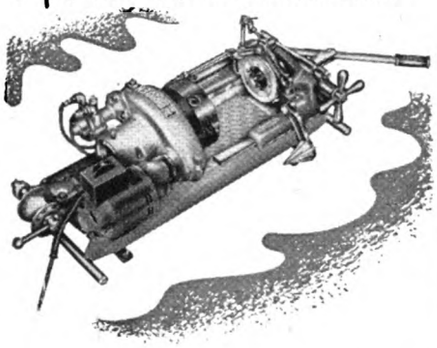
TIMKEN TRADE-MARK REG. U.S. PAT. OFF. *TAPERED ROLLER BEARINGS*



NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

• LIGHTWEIGHT
• LOW-PRICED
• EASY-TO-MOVE

the New Beaver Model-E Pipe and Bolt Machine



The new low-priced, lightweight Beaver Model "E" is a "junior edition" of the heavy-duty Beaver Model A—which has, for the past 20 years, been the recognized leader in the field of portable pipe and bolt machines.

The Model "E" uses the same dieheads--the same dies—the same patented interchangeable wheel-and-roller or knife cutoff devices—the same reamer arm and cone—as the Models A and B. This will be a great advantage to thousands of shops now equipped with the Beaver Model A or B because it eliminates the necessity of carrying in stock duplicate dies and parts—thereby preventing endless confusion and needless expense. And remember, there are 195 different kinds and sizes of dies instantly available for Models A, B or E.

Although designed primarily for hardware stores and small piping contractors, BIG contractors will find the new Model "E" useful on jobs requiring extreme portability.

A pipe machine is no better than the service back of it and our 50 years of experience in this field, and our reputation for high quality and friendly service, is your best guarantee of complete satisfaction.

WRITE FOR BULLETIN E

BEAVER PIPE TOOLS

272-300 Dana Ave., Warren, Ohio

Delbridge was associated with the Air Reduction Sales Company for 20 years, and joined K-G, a unit of Air Products, Inc., six months ago.

◆

ACME COMPANY.—*Boetius H. Sullivan, Jr.*, vice-president and general manager of the Orme Company, has been elected president of the firm.

◆

DETREX CORPORATION.—*W. I. Tebo* has been appointed engineering consultant and technical adviser for the Detrex Corporation at Washington, D. C. His headquarters will be at the Shoreham Hotel.

◆

VANADIUM CORPORATION OF AMERICA.—*Roy F. Hancock* has been appointed assistant to vice-president in charge of sales for the Vanadium Corporation of America,



R. F. Hancock

with headquarters at 420 Lexington Avenue, New York. Mr. Hancock formerly was associated with the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa., as manager of eastern alloy steel sales.

◆

BULLARD COMPANY—*H. Edward Neale* has been appointed assistant sales manager of the Bullard Company at Bridgeport, Conn. *James L. Shay* succeeds Mr. Neale as representative in the Chicago area and will be located at the offices of Marshall & Huschart Machinery Co., 571 Washington boulevard, Chicago.

Mr. Neale became associated with the Bullard Company in 1935 as a student engineer and served in various departments throughout the plant until 1947 when he was selected company representative for the New York State territory. In late 1949 Mr. Neale was given the Chicago territory working out of the offices of Marshall & Huschart Machinery Co.

◆

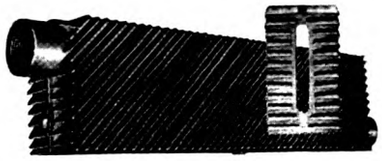
SIMPLEX WIRE & CABLE CO.—*J. N. Macalister*, manager of the Chicago district office of Simplex Wire & Cable, has retired. *W. H. Davis*, who became associated with the company in 1927, succeeds Mr. Macalister.

◆

FAIRBANKS, MORSE & CO.—*S. W. Hickey* has been appointed assistant manager of the Railroad Products department of Fairbanks, Morse, with headquarters at 600 South Michigan avenue, Chicago. *Orren*

WILSON

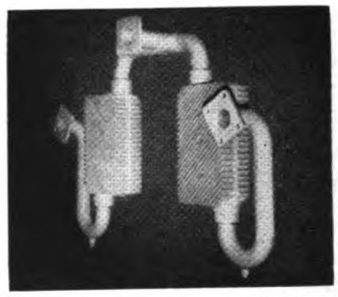
All-Cast Aluminum Directional-Finned Radiation Elements



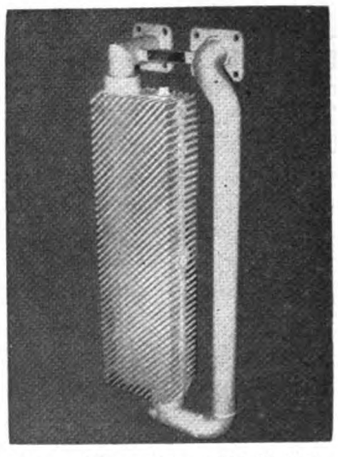
FOR USE AS:

Air compressor intercoolers—diesels; final cooling of compressed air; diesel locomotive fuel oil heaters; stationary compressor installations; unit heaters; mobile de-icing and drying machines.

Wilson Compressed-Air Inter Coolers



Above—Wilson Radiation Elements for compressed air intercooler application. Furnished as shown complete with elements, and all piping and flanges.



Above—Wilson Type ADX Air Compressor Intercooler. Furnished completely assembled with radiation element and piping. Factory tested to 300 p.s.i.

Manufactured By:

WILSON ENGINEERING CORP.

122 South Michigan Blvd.
Chicago 3, Illinois

Esso Diesel Fuel

"Tailor-made" to railroad specifications



ESSO DIESEL FUEL has been specifically developed to meet the requirements of railroad diesels. In one of the most exacting tests ever conducted Esso Diesel Fuel was proved on the run through over 300,000 miles of actual railroad operations in a diesel engine. For an economical, dependable diesel fuel specify ESSO.

BACKED BY CONSTANT RESEARCH — keeping pace with latest engine design and developments Esso Railroad Products are constantly being tested and improved.

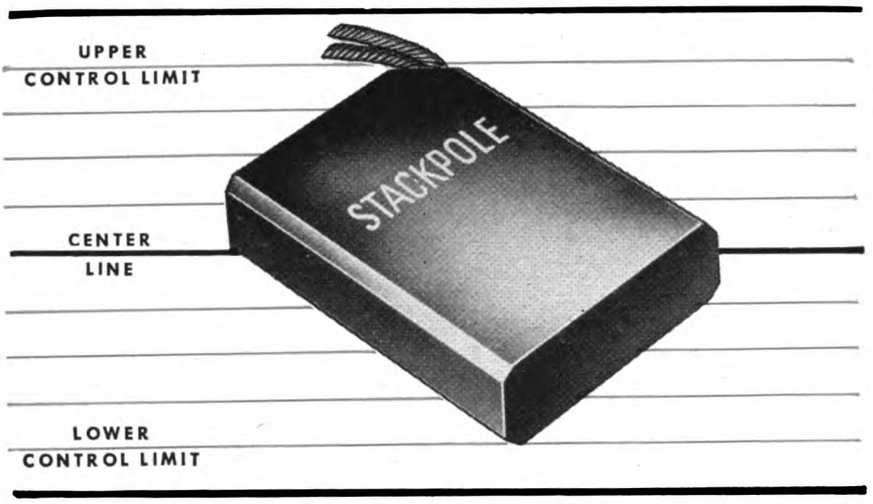
BACKED BY CONSTANT FOLLOW-UP — on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any railroad fuel or lubricating problem.

The Sign of QUALITY **ESSO** *The Symbol of SERVICE*

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penn., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.



quality controlled...
for uniform dependability

The uniform dependability of Stackpole Diesel Brushes is the direct result of long, specialized experience PLUS statistical Quality Control in every step of production. Stackpole Quality Control means that brush characteristics are kept at highly uniform levels—long life and minimum commutator wear are assured.

STACKPOLE CARBON COMPANY
St. Marys, ● *Pa.*
Carbon-Graphite specialists for over 30 years

STACKPOLE
Diesel-Electric
BRUSHES

S. Leslie has been appointed manager of the company's plant at Beloit, Wis., succeeding Henry M. Haase, who has resigned.



O. S. Leslie

Mr. Hickey had previously been with the Simmons-Boardman Publishing Corporation, publishers of the Railway Mechanical and Electrical Engineer, with which company he became associated in 1931. He served in the circulation department, as sales representative in the advertising department, and as western manager of sales until February, 1946, when he became also a vice-president of the corporation.



S. W. Hickey

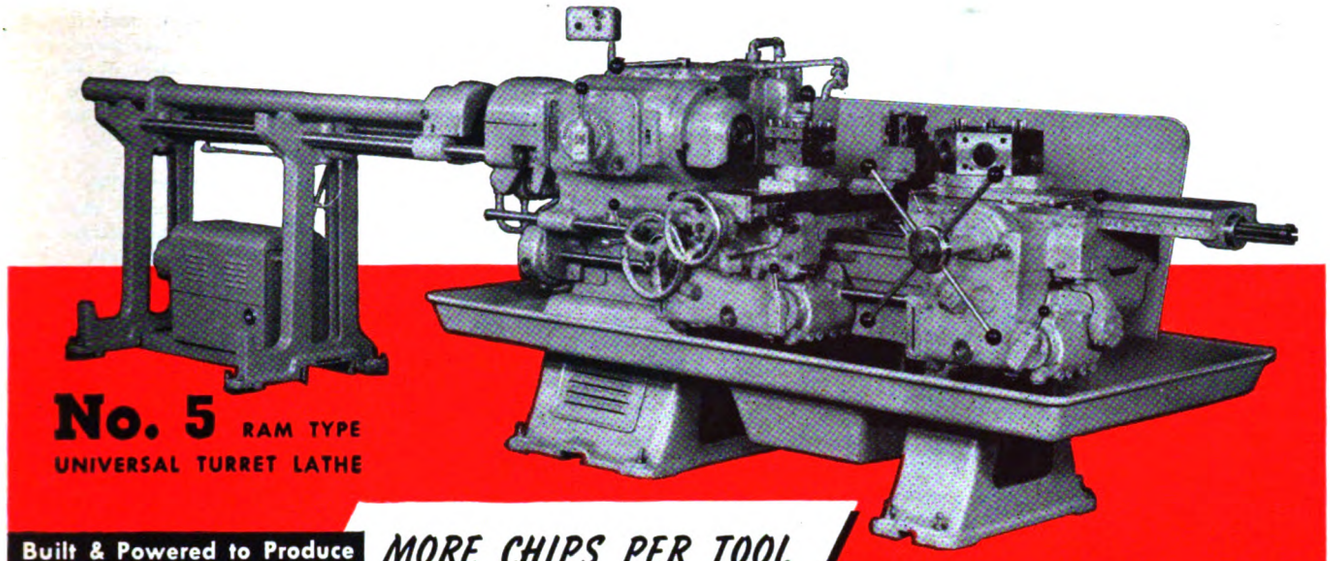
◆

YALE & TOWNE MANUFACTURING CO.—*Edward J. Heimer*, formerly a vice-president of Clapp & Poliak, Inc., has been appointed sales manager of hand lift and motorized hand trucks made by the Philadelphia, Pa., division of Yale & Towne Manufacturing Co. Mr. Heimer will succeed W. Glen Tipton, retired.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*S. C. Palmer* has been appointed assistant manager of the transportation department of the Westinghouse Electric Corporation, East Pittsburgh Works.

Mr. Palmer is a graduate of Tufts College (1931) with a Bachelor's degree in mechanical engineering. He joined Westinghouse that same year as a member of the graduate student course and in July, 1934, was assigned to sales duties in the Boston office. In March, 1936, he was named



No. 5 RAM TYPE
UNIVERSAL TURRET LATHE

Built & Powered to Produce *MORE CHIPS PER TOOL*
MORE PIECES PER HOUR
MORE PROFIT PER JOB **than any other turret lathe of comparable size**

Jones & Lamson offers the best investment in turret lathes. They are backed by the "know how" of a firm, long predominant in the field, whose many pioneered and perfected developments have brought about far-reaching advances in the art of cutting metal.

Every feature of these lathes has been developed through long-range research and practical experience in production turning. Their superior performance stands out over any other machine of comparable size, because they are built to hold their accuracy at the highest speeds and feeds possible with modern cutting tools — with ample reserves to anticipate new cutting techniques. Jones & Lamson Turret Lathes have a well-earned reputation for ease of operation, low operating costs and year-round dependability. They are recognized for their advantages in *SPEED, POWER, RIGIDITY AND REPETITIVE ACCURACY.*

They will pay for themselves quickly through savings in direct costs alone!

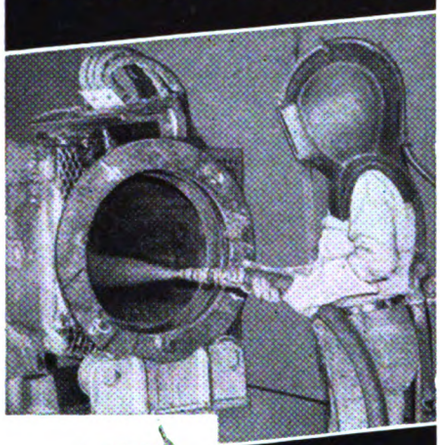
- Single lever speed selector — 12 spindle speeds 30 to 1500 RPM or 20 to 1000 RPM
- 15 HP constant speed motor — ample horsepower available at all speeds
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- Single lever hexagon turret feed selector — 9 longitudinal turret feeds
- All longitudinal and cross feeds automatically disengaged against positive stops
- Heavy-duty spindle mounting with rugged preloaded anti-friction bearings
- Heat-treated, precision-finished, long-wearing alloy steel gears
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- Hardened and precision ground steel ways — 12½" in overall width
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- Complete coolant system — automatic internal delivery to each hexagon turret face
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There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

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manager of the marine and transportation division in the New England District.

◆

ALUMINUM COMPANY OF AMERICA.—The Aluminum Company of America is building a new alumina plant near Buxite, Ark., which will be operated by its subsidiary the Aluminum Ore Company. The new plant is expected to increase by nearly 50 per cent the amount of alumina now being produced by the company.

◆

HEYWOOD-WAKEFIELD COMPANY.—*Severin B. Hendrickson* has been appointed to the newly created position of manager of transportation seating in addition to his other duties at division headquarters; *E. Harry Reid* has been appointed assistant manager of the division; and *George E. Cornwall* has resigned as sales manager of the division, but will continue as New England sales representative for transportation seating. *Guy M. Ralph* has joined the sales staff of Heywood-Wakefield at New York.

◆

LORD MANUFACTURING COMPANY.—*Robert T. Daily* has been promoted to field engineer in charge of the Chicago office of the Lord Manufacturing Company. He will report to Charles L. Freel, manager of the field engineering department at the home office, Erie, Pa.

◆

JOHN A. ROEBLING'S SONS COMPANY.—*Howard E. Maloney* has been appointed manager of sales; *Frank T. Craven*, assistant manager of sales, and *Roy H. Hainsworth*, eastern regional manager, of the Electrical Wire Division of John A. Roebling's Sons Company, Trenton, N. J. Mr. Maloney was previously assistant manager.

◆

H. K. PORTER COMPANY.—The H. K. Porter Company has acquired the *Delta Star Electric Company*, manufacturer of high voltage electrical equipment.

◆

DEARBORN CHEMICAL COMPANY.—*D. B. Bishop*, sales representative for the Dearborn Chemical Company in the Pittsburgh, Pa., area, has been appointed manager of the company's office in that city, succeeding *J. A. Crenner*, who has retired.

Obituary

JOHN G. LITTLE who retired in 1948 as Assistant to Vice President of the Simmons-Boardman Publishing Corporation died recently.

E. J. HILJES, general sales manager of the William Sellers Division, Consolidated Machine Tool Corporation, 1601 Chestnut street, Philadelphia, Pa., died February 3 in Delaware County Hospital. He was 66.

Mr. Hiljes attended Johns Hopkins University and Lehigh University. He had been with the William Sellers Company, Philadelphia, for more than 40 years and was appointed general sales manager when that company merged its machine tool interests with Consolidated Machine Tool

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No. 40

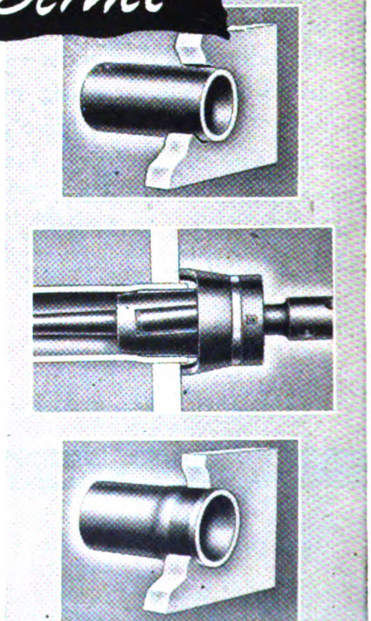
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MINIMUM FRICTION . . . absorbed by bronze bearing between guard and frame, resulting in much easier and faster operation.

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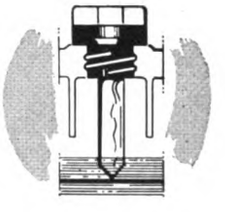
Gould Batteries with new "Z" Plates have the extra reserve capacity that you need to keep your engines available. 96% of the working surface of these plates is *regenerative* power-producing material. Grids are 66% more resistant. Porosity of grid metal is reduced 85%.

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Always Use Gould-National Automobile and Truck Batteries
*Formerly Gould Storage Battery Corporation

Corporation, Rochester, N. Y., in 1947.

During World War II Mr. Hiljes was a civilian adviser on heavy machine tools to the U. S. Navy, Bureau of Ships. He was a member of the Union League.

ROBERT E. THAYER, vice-president and a director of the Simmons-Boardman Publishing Corporation, died suddenly on February 25. Mr. Thayer was born in Chelsea, Mass., on August 4, 1883. After graduation from the Massachusetts Institute of Technology he became a special apprentice with the American Locomotive Company, later was an instructor for two years at M.I.T., and a draftsman for one year on the Boston & Maine. He became associated with the Simmons-Boardman Publishing Corporation in 1911 as associate editor of the *Railway Age Gazette*. In 1917 he was appointed mechanical department editor of the *Railway Age* and managing editor of the *Railway Mechanical Engineer*, and in 1919, European editor of the *Railway Age*, with headquarters at London, England. On his return to this country in 1922 he was transferred to the sales department. In 1929 he became business manager of the *Railway Mechanical Engineer* a position he held until 1947. In 1937 he was elected a vice-president of the company. He was business manager of the Locomotive Cyclopedia and the Car Builders' Cyclopedia, published by the Simmons-Boardman Publishing Corporation. He was a member of the American Society of Mechanical Engineers.



Robert E. Thayer

DAVID W. LAMOREAUX, president of Peerless Equipment Company, died at St. Luke's hospital in Chicago on January 1, at the age of 66. Mr. Lamoreaux began his career in the railroad field in the mechanical department of the Wheeling & Lake Erie. Subsequently he was associated with the National Refining Company, and later with the Journal Box Servicing Corporation of Indianapolis, Ind. In June, 1937, he became president of Peerless Equipment Company.



David W. Lamoreaux

JOHN P. HOELZEL, president of the Pittsburgh Screw & Bolt Corp., died at his home in Pittsburgh, Pa., on December 26. He was 67 years old.

HARRY HANSON, vice-president and secretary of the Griffin Wheel Company, died at Chicago on January 12, after 48 years service with that company.

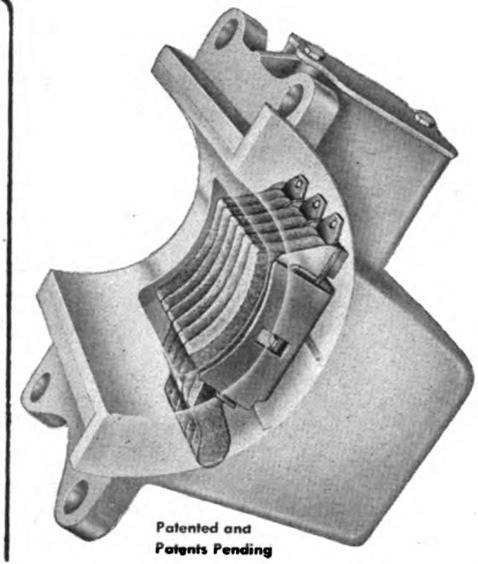
ANDREW W. MACLEAN, vice-president of the MacLean-Fogg Lock Nut Company, Chicago, died on January 28 at St. Louis, Mo. Mr. MacLean was born in 1890 at Chicago and had been associated with MacLean-Fogg since 1928. He entered the company's service at Chicago and in 1934 moved to St. Louis, where he resided until his death.



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PERSONAL MENTION

General

WARREN P. HARTMAN, whose appointment as assistant general manager of the Atchison, Topeka & Santa Fe System's mechanical department, with headquarters at Chicago, was reported in the January issue, was born at Longmont, Colo., on February 1, 1891. He received his B. S. degree in mechanical engineering from the University of Colorado in 1914. He then entered the employ of the Santa Fe as a special apprentice at La Junta, Colo. Advancing steadily in the mechanical department, he served as apprentice instructor and erecting foreman at La Junta and Raton, N. M., and was appointed enginehouse foreman at Raton in 1921. He was appointed general foreman at Albuquerque, N. M., in 1923; transferred to Amarillo, Tex., as fuel supervisor in 1931, and promoted to master mechanic at Slaton, Tex., in 1934. Mr. Hartman was transferred to Argentine, Kan., three years later, and was appointed to mechanical superintendent at Topeka, Kan., in 1941. He became mechanical superintendent of the Coast Lines at Los Angeles, Cal., in July, 1943.



Warren P. Hartman

FRANK J. KOSSUTH, assistant superintendent of equipment, Lines East, of the New York Central, has been appointed assistant to general superintendent of equipment of the system, with headquarters at New York.

THOMAS T. BLICKLE, whose appointment as mechanical superintendent of the Atchison, Topeka & Santa Fe's Coast Lines with headquarters at Los Angeles, Cal., appeared in the January issue, was born on May 12, 1909 at Rochester, Minn. He entered Santa Fe service as a shop apprentice at Ft. Madison, Iowa, in 1927. After completing his machinist apprenticeship in 1931, Mr. Bickle served as stationary fireman and stationary engineer at Chicago until 1936, when he became a machinist at the 18th Street diesel shops. He was appointed diesel maintainer at Chicago six months later; assistant supervisor of diesel engines in 1941; supervisor



T. T. Blickle

of diesel engines at Chicago in July, 1942, and master mechanic at Dodge City, Kan., in March, 1947. He was transferred back to Chicago in September, 1949, as mechanical assistant.

WILLIAM H. ELSNER, for the past 20 years mechanical engineer of the Great Northern at St. Paul, Minn., has retired. Mr. Elsner became a draftsman for the Great Northern in 1910 and was subsequently chief draftsman and assistant mechanical engineer. Previous to 1910 he had been employed by the Northern Pacific; the Chicago & Alton (now the Gulf, Mobile & Ohio); the Pressed Steel Car Company at McKees Rocks, Pa.; the Chicago & North Western at Chicago, and the Pullman Car & Manufacturing Co. at Chicago.

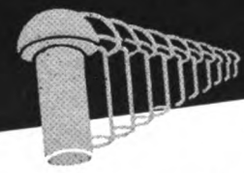


William H. Elsner

H. G. DUGAN, master mechanic of the Toledo Terminal at Toledo, Ohio, has been appointed superintendent of operations and motive power. The position of master mechanic has been abolished.

HENRY L. BONSTEIN, mechanical engineer of the Lehigh Valley at Sayre, Pa., has retired after 50 years of service with that road. Mr. Bonstein began his career at South Easton as a draftsman in the en-

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It's equipped with the proven Johnston non-clogging vacuum oil burner. Because it's engineered with experience there's no oil valve—no small passage to clog! It's available in portable or stationary types. For safety, for dependability, for economy, order the Johnston Rivet Forge!

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When "Old Reliable"—the L & N—needed a cleaner for use in lye vat operations, they proceeded with typical thoroughness in making their selection:

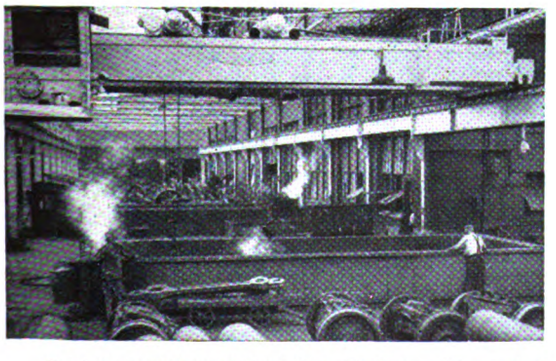
Rigidly controlled tests were run in their South Louisville shops. These tests covered many cleaning cycles over a six-month period.

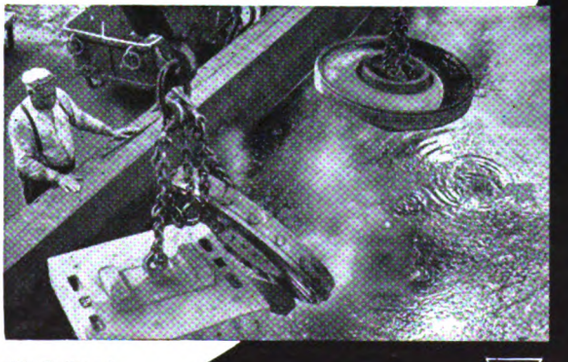
RESULT: A Pennsalt Cleaner was selected for exclusive use in locomotive parts maintenance.

The L & N found that the Pennsalt Cleaner cut cleaning time substantially. What's more, real economies were realized: Vat solutions of Pennsalt Cleaner lasted longer than other cleaners . . . a worth while saving when dealing with 20,000 gallon vats.

The Pennsalt representative in your locality will be glad to study your maintenance cleaning operations—help you set up tests to determine the most economical methods. Write to Maintenance Chemicals Dept., Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

Progressive Chemistry
for over a Century





(Left) General view of South Louisville Shops of Louisville & Nashville Railroad.
(Right) Locomotive parts being lowered into tank of Pennsalt Cleaner solution.

PENN SALT
railroad maintenance cleaners

gineering department of the L.V. He was chief draftsman before becoming mechanical engineer in 1938. Mr. Bonstein subsequently supervised the L.V. maintenance of equipment department and was responsible for the designing of all equipment.

M. C. SHARP, superintendent of automotive equipment of the Chicago, Rock Island & Pacific, has been appointed assistant to the general superintendent of motive power, with headquarters in Chicago.

W. C. MILLER, chief draftsman in the mechanical department of the Great Northern at St. Paul, Minn., has been appointed mechanical engineer with headquarters at St. Paul. Mr. Miller entered the service of the G. N. in 1918 as draftsman, and has been chief draftsman for 10 years.

B. J. MAGUIRE has been appointed assistant to superintendent motive power of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Milwaukee, Wis.

JOHN A. BROSSART, assistant to general superintendent of equipment, of the New York Central System at New York, has retired after 47 years with the company.

C. H. GRAY, assistant shop superintendent of the Chicago, Rock Island & Pacific at Silvis, Ill., has been appointed superintendent of automotive equipment, with headquarters in El Reno, Okla. Mr. Gray will have jurisdiction over the second mechanical district of the road, which comprises the Missouri-Kansas, Pan Handle, Oklahoma, Southern, and Arkansas divisions.

GEORGE H. MASSY, superintendent of motive power and rolling equipment of the New Jersey Central at Elizabethport, N. J., has been appointed superintendent of floating equipment at Jersey City, N. J.

HENRY P. MACDONALD, chief draftsman of the Lehigh Valley, has been appointed mechanical engineer, with headquarters as before at Sayre, Pa. Mr. MacDonald was born at Newton, N. J., and entered the service of the L.V. at South Easton, Pa., as a machinist apprentice in 1923. He later later served as draftsman at Bethlehem, Pa., and Sayre and was appointed chief draftsman at the latter point on April 1, 1948.

T. R. SMITH, diesel supervisor of the Chicago, Rock Island & Pacific at Chicago, has been appointed superintendent of automotive equipment, with headquarters at Chicago. Mr. Smith will have charge over the first mechanical district of the Rock Island, which comprises the Chicago, Rock Island, Cedar Rapids, Des Moines and Western divisions, and Trenton, Mo.

HENRY E. WHITENER, master mechanic at the Communipow engine terminal of the Jersey Central Lines, Jersey City, N. J., has been appointed superintendent of motive power and rolling equipment at Elizabethport, N. J.



economy

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COFFING Safety-Pulls

To save unnecessary labor, to protect men and equipment is sound economy. That's why wise foremen specify Coffing Safety-Pull Ratchet Lever Hoists. Whether for pulling pistons, removing cylinder liners or installing heavy parts and assemblies of all kinds, these powerful tools provide tireless lifting, holding, pulling power wherever used—letting one man replace a crew.

Special ratchet and pawl cannot slip, yet chain is free-wheeling when not under load. Nine sizes to fit every requirement. Capacities from 3/4 to 15 tons — all factory tested at 100 percent overload. Find out how Coffing Safety-Pulls can bring added economy to shop operations. Write for Bulletin H3SP.

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Danville, Illinois

Car Department

GEORGE E. MCCOY, assistant chief of car equipment of the Canadian National at Montreal, Que., has retired under the pension rules of the company. Mr. McCoy was born at Moncton, N. B., and entered railroad service in 1900 as mechanical draftsman apprentice with the Intercolonial (now C. N.), becoming draftsman in 1905. In 1914 he was appointed assistant chief draftsman of the Canadian Government Railways (now C. N.), and in 1916 became assistant master car builder. Mr. McCoy was appointed master car builder of the eastern lines of the C. N. in 1918, superintendent of car equipment of the Atlantic region in 1923, general superintendent car equipment of the same region at Moncton in 1928, assistant general superintendent car equipment of the Central region at Toronto, Ont., in 1932, and assistant chief of car equipment of the system at Montreal in 1943.

F. J. KOSSUTH, assistant superintendent equipment of the New York Central, Lines Buffalo and East, has been appointed assistant to general superintendent equipment—car, with headquarters as before at New York.

H. J. YOUNG, general foreman, passenger-car department of the New York Central at Beech Grove, Ind., has been appointed superintendent of the Beech Grove car shop.

P. F. SPANGLER, assistant superintendent motive power of the St. Louis-San Francisco, has been appointed superintendent car department, with headquarters at Springfield, Mo.

Shop and Enginehouse

FRANK A. LONGO, general boiler inspector of the Southern Pacific at San Francisco Cal., has been appointed general welding and boiler inspector, with headquarters at San Francisco. Mr. Longo's duties will include the inspection of welding methods, practices and equipment in motive power and car department, as well as those of general boiler inspector.

GUS FERTAKOS, day general foreman of the Central of New Jersey, has been appointed master mechanic at the Communipaw engine terminal, Jersey City, N. J.

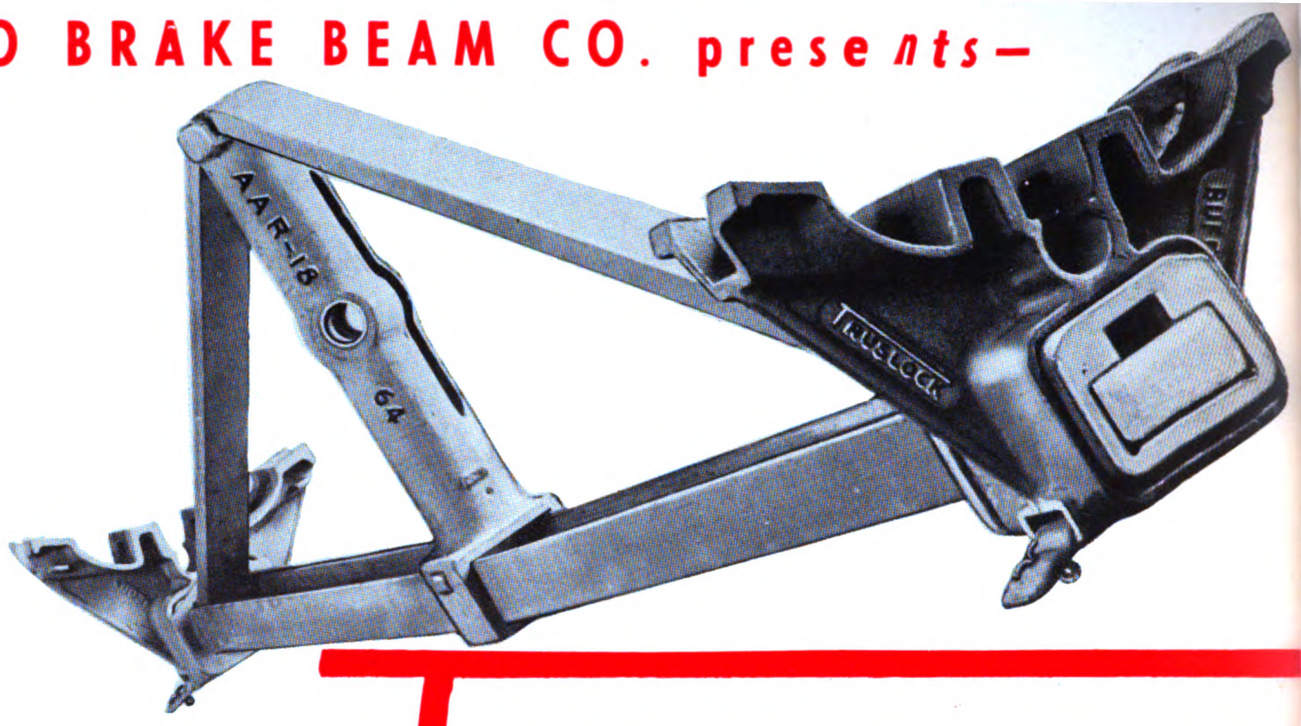
F. W. WILBOURNE, shop inspector of the Norfolk & Western at Crewe, Va., has been appointed gang foreman at the Petersburg, Va., shop.

E. H. WRIGHT has been appointed general foreman of the New York Central at Elkhart, Ind.

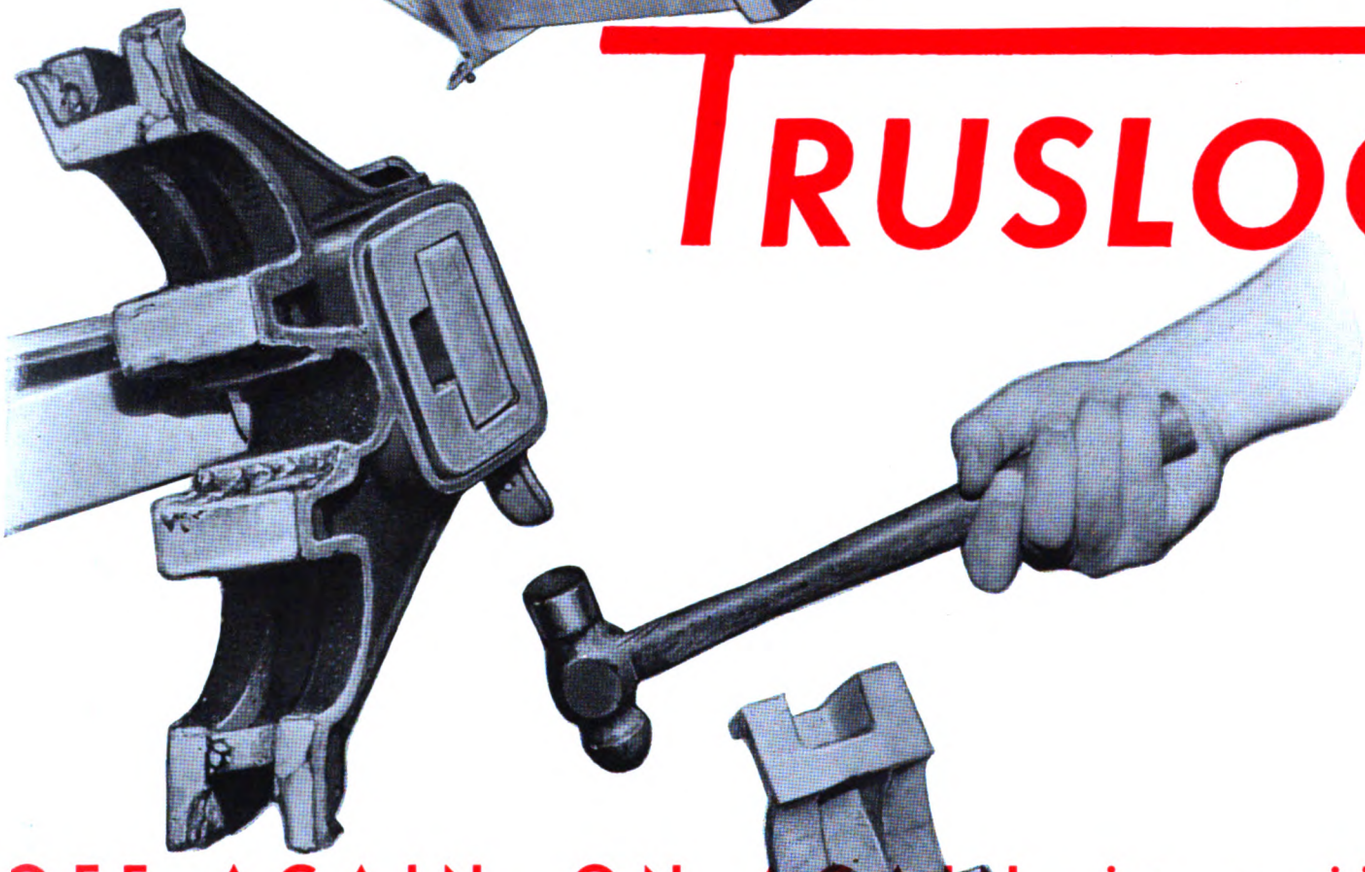
Obituary

H. A. SJOGREN, assistant to superintendent car department of the Chicago, Milwaukee, St. Paul & Pacific, at Milwaukee, Wis., died on January 7 at his home in that city.

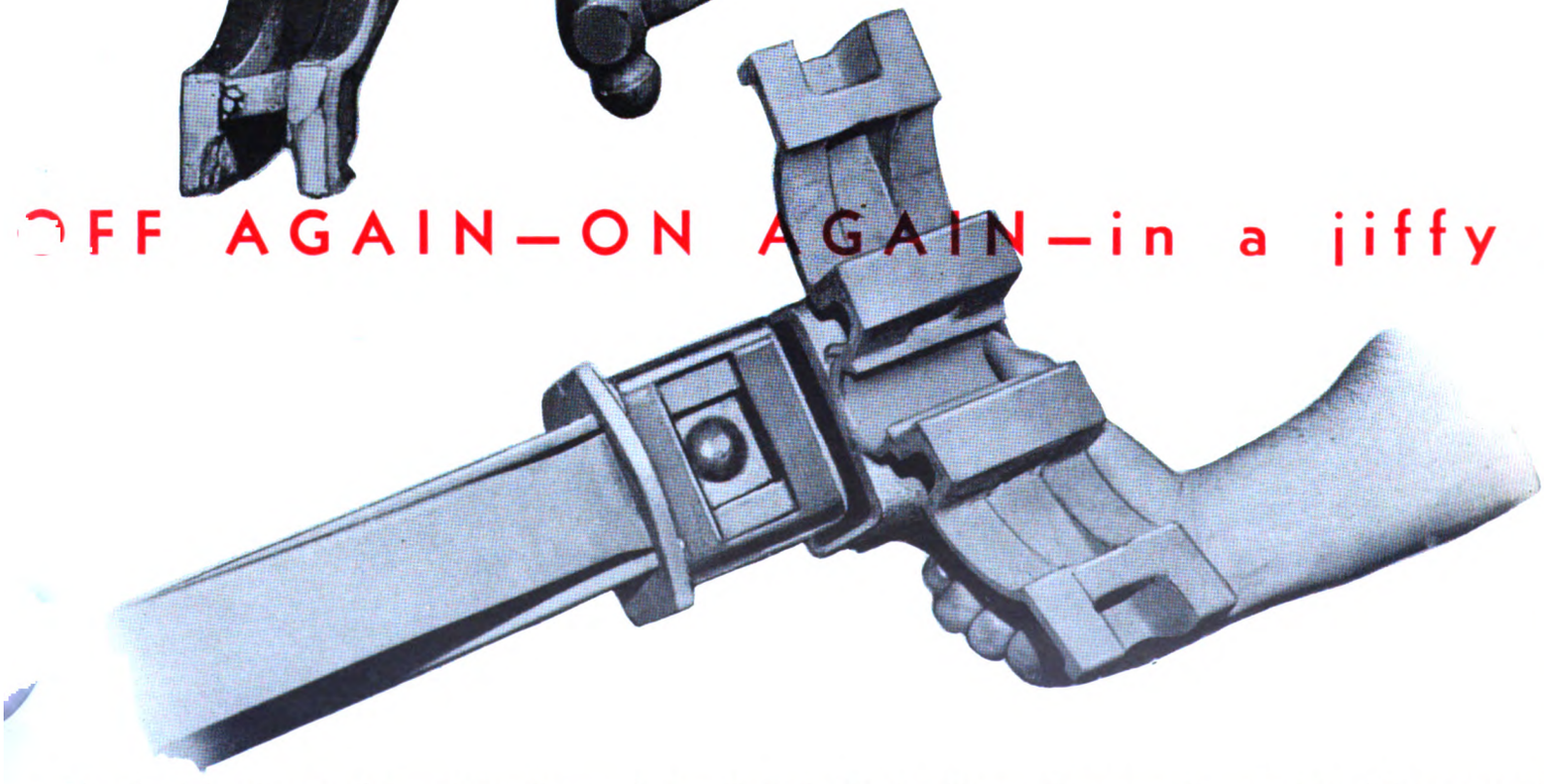
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APRIL, 1951

RAILWAY Mechanical and Electrical Engineer

Founded in 1832 as the American Rail-Road Journal.

VOLUME 125 No. 4

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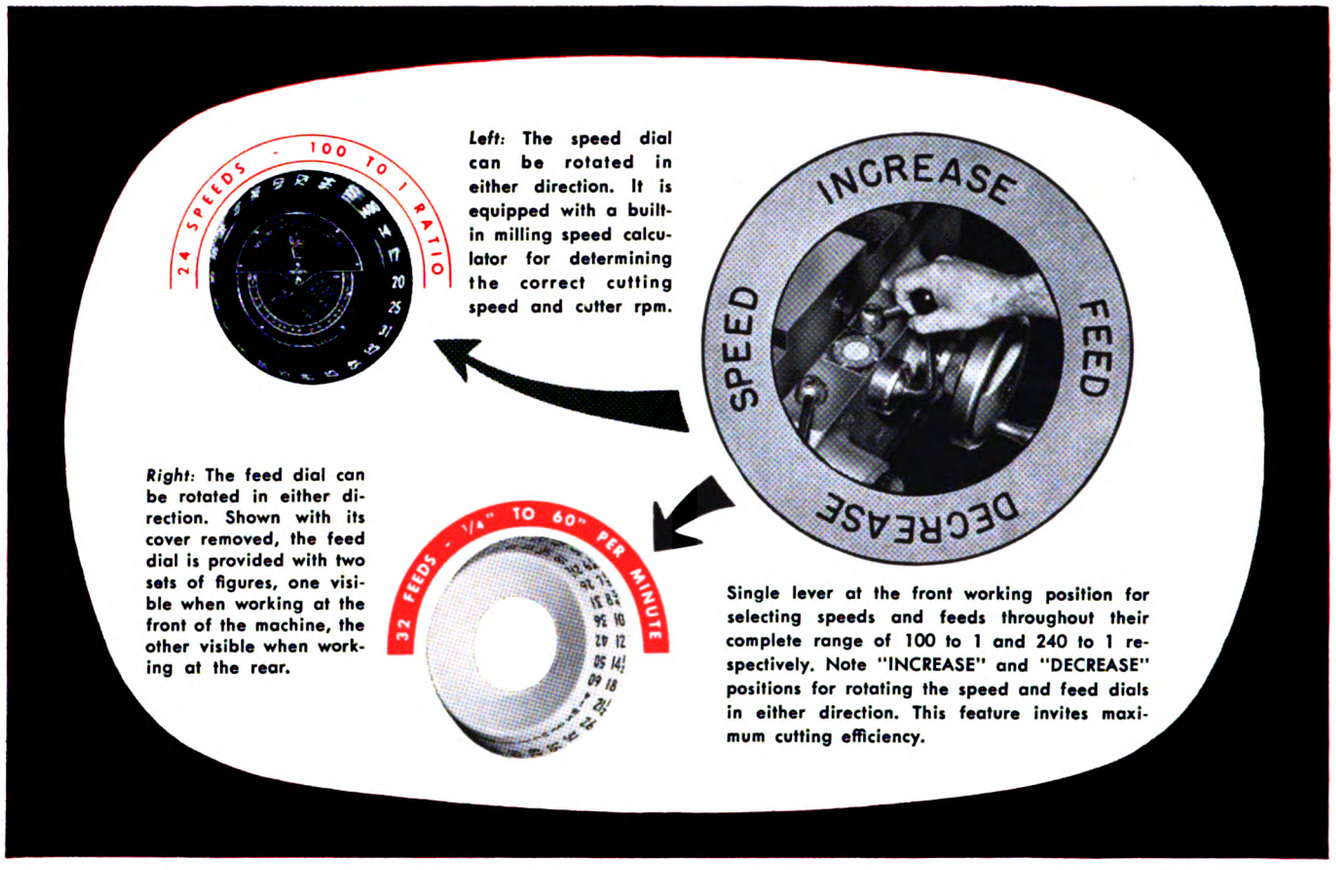
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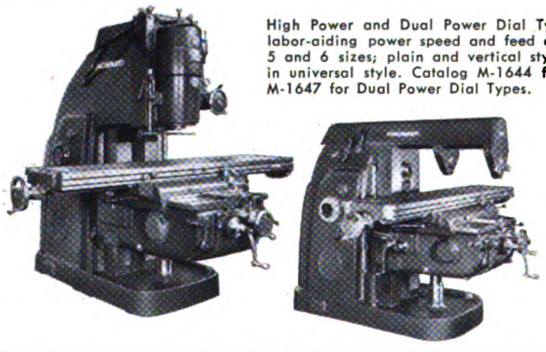
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Left: The speed dial can be rotated in either direction. It is equipped with a built-in milling speed calculator for determining the correct cutting speed and cutter rpm.

Right: The feed dial can be rotated in either direction. Shown with its cover removed, the feed dial is provided with two sets of figures, one visible when working at the front of the machine, the other visible when working at the rear.

Single lever at the front working position for selecting speeds and feeds throughout their complete range of 100 to 1 and 240 to 1 respectively. Note "INCREASE" and "DECREASE" positions for rotating the speed and feed dials in either direction. This feature invites maximum cutting efficiency.



High Power and Dual Power Dial Type Milling Machines have labor-aiding power speed and feed change. Built in Nos. 3, 4, 5 and 6 sizes; plain and vertical styles; Nos. 3, 4 and 5 sizes in universal style. Catalog M-1644 for High Power Dial Types; M-1647 for Dual Power Dial Types.



ONE LEVER

SELECTS THE RIGHT SPEED AND FEED FOR THE JOB

It's almost as easy to do as to talk about it. That's why operators really like the High Power and Dual Power Dial Types. They're big, rugged, take heavy cuts (up to 50 hp for the largest sizes), yet they're exceptionally convenient and easy to run. This one Cincinnati feature of power speed and feed selection, at the *front and rear working stations*, goes a long way toward reducing milling costs. Efficient cutting becomes a habit with the Dial Type operator because it's so easy to select the right combination of speeds and feeds. There are other features, too, of interest to both shopmen and management. You will find them outlined in two attractive catalogs: Nos. 3, 4, 5 and 6 High Power Dial Types, M-1644. Nos. 3, 4, 5 and 6 Dual Power Dial Types, M-1647.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

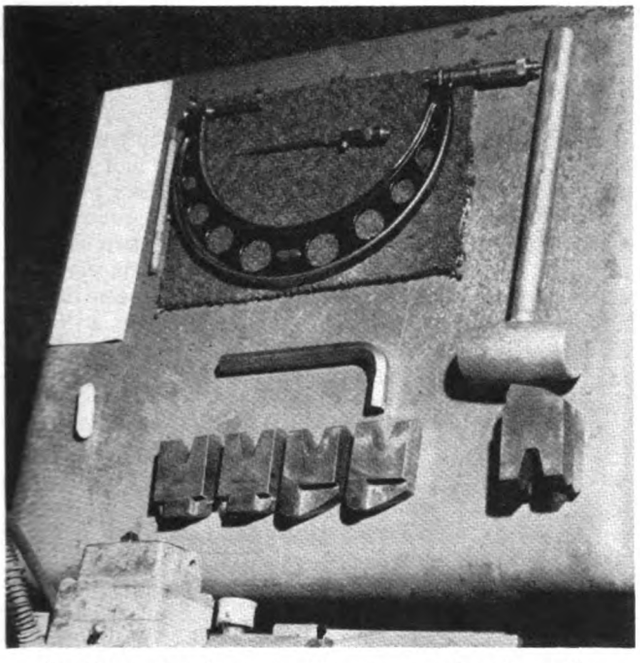
MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

RAILWAY Mechanical and Electrical Engineer

Modern Shop Tools and Visual Instruction in Their Use*

Design, manufacture and use of cutting tools on the Southern Pacific, particularly in wheel and axle work, are described in this paper

By F. E. Molloy†



Good housekeeping generally means good workmanship

PRIOR TO 1933 almost all cutting tools were made of carbon steel. Little high speed steel was used, except on highly specialized jobs, because of lack of facilities for proper heat treating and hardening. However, during the following ten-year period high speed steel gradually came into more general usage.

In 1943, so as to be in a position to handle the high-speed tool steels, the Southern Pacific purchased and installed at Sacramento general shops an atmospherically controlled electric heat-treating furnace. With this equipment it was possible to extend the use of high speed steel to machine cutting tools, reamers, milling cutters and many other applications. This resulted in sizable savings in tool inventories, maintenance and production labor costs.

During World War II the amount of high-speed steel available declined sharply, and in order to conserve the supply the practice of tipping of cutting tools was begun. This proved to be so economical that it was almost universally adopted as standard practice. For example, just prior to the time we started using locomotive tire steel, obtained from the stores department reclamation plant, for making tool shanks, milling arbors and other tool holders our consumption of high speed steel was approximately 36,000 lb. per year. This has dropped to approximately 16,000 lb., a 56 per cent decrease.

Stellite and carbide steels were introduced during 1939. For several years following that date they were used principally for trial purposes and in comparison to high speed steels. Their application for production work was strictly limited.

Since World War II, carbides and cobalt products have become quite popular as general cutting steels. Among the advantages of carbides over high speed steels are:

1. Tool life, in terms of time between regrinds or reprocessing, is increased considerably. For example, when boring and turning locomotive side rod bushings with high-speed steel tools it was necessary to regrind the tools two or three times in an eight-hour shift. When carbide tools are used the tool life between regrinds is approximately three eight-hour shifts.

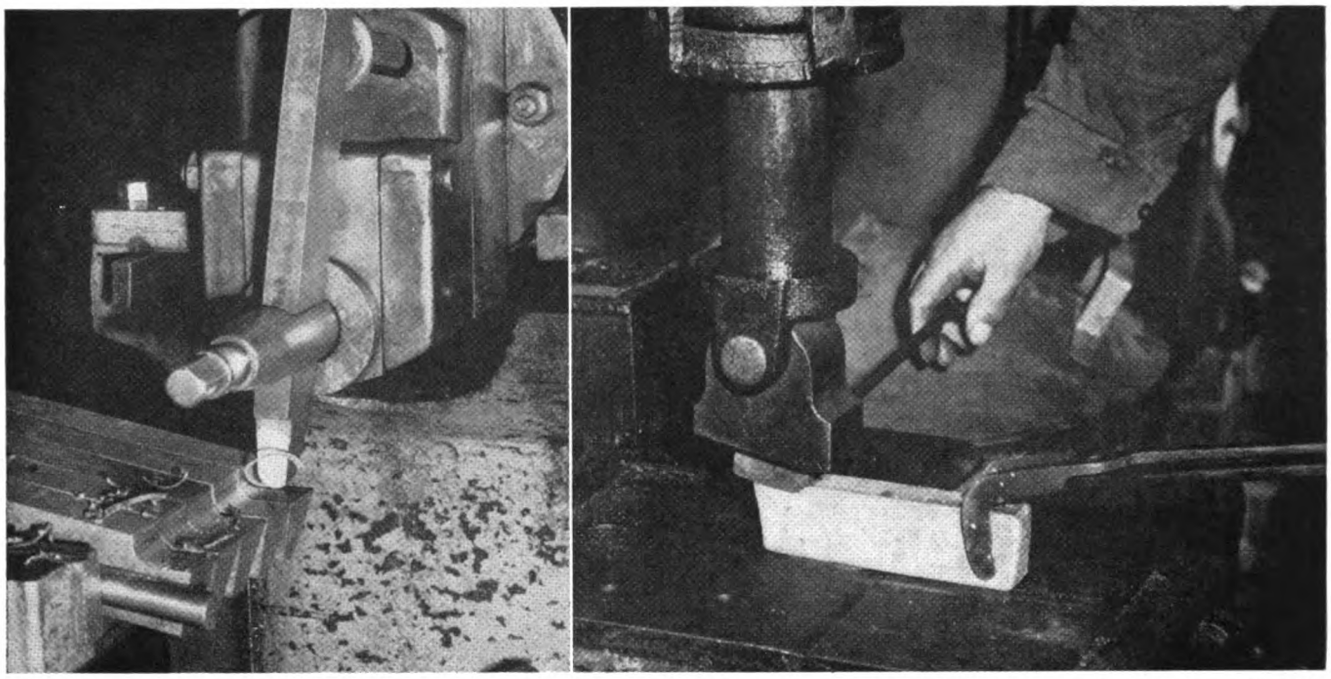
2. Carbide steels will easily cut through abrasives, such as are present on most sand castings, and hard spots like those found on locomotive tires and steel wheels.

3. The ability of carbides to cut metal at much higher temperatures makes it possible to operate the machines at faster speeds, increasing their productivity and providing a higher rate of return on the investment in the machine.

To obtain the benefits which carbide tools can provide, the machines in which they are used must have ample horsepower and a wide range of speeds and feeds. Accepting this fact, it then may be necessary to rebuild and modernize some of the older machines. At Sacramento general shops our first step in the modernization program was to remove all line shafting and belting and

* Abstract of a paper presented before the Pacific Railway Club, October 19, 1950.

† Assistant superintendent of motive power, Southern Pacific, Sacramento, Cal.



Left: Shaping machine cutting shelf on tool shanks to receive tool tips. Right: Method of applying high-speed tool tip to tool shank



Checking wheel-seat diameters in carding sizes to be used for wheel boring

apply individual drive mechanism to the various machines. Obsolete machines were scrapped, and others were redesigned. In addition, we purchased a number of modern turret lathes, boring mills, milling machines, engine lathes and other equipment, enabling us to make wide use of carbide tools and increasing our production.

Power and Tool Costs Reduced

In addition to increased production, there are two items, frequently overlooked, which effect cost reductions when machinery is modernized or new equipment purchased. These are power consumption and tool cost, including the cost of tool service life. A modern machine, having ample power to produce a constant torque over a wide range of speeds and feeds, may replace two or three older machines, each of which has a drive motor consuming electric power. Our experience has been that in many instances cash savings in tool inventories and maintenance, resulting from the purchase of new machines or modernization of existing shop machinery, are greater than the savings in direct labor.

An important factor in obtaining maximum efficiency from cutting tools is the system used in manufacture and maintenance. At many shops on our system this is handled by a centralized tool department equipped with modern tool grinding equipment, and all tools are ground to standard design by experienced operators. An additional function of the central tool department is a tool delivery service. A service wagon is used to deliver tools to the machines where they are to be used and to pick up worn tools and return them to the tool room for regrinding. We have also installed modern tool cribs to replace older tool storage spaces, and this has enabled us to further cut tool inventories and reduce overhead on tools and other supplies. It has been found that this method of handling tool processing and distribution results in appreciable savings.

Tool service life is usually figured on the basis of the number of pieces of finished work obtained per regrind. Experience at Sacramento shops indicates longer tool service life can be realized if the operator hones the cutting edges during the period between regrinds. The honing removes any soft metal which may build up on the cutting edge. This soft metal, if not removed from the tool edge, will become wedged between the work piece and the cutting edge and cause cratering and breaking down of the tool. The time required to hone the tool occasionally is negligible and the amount of work obtained from the tool before it must be returned to the tool department is increased considerably. Total tool life

can be extended by the practice of removing the tool before a complete breakdown of the cutting edge takes place. When this practice is observed the regrinding time and the amount of metal removed from the tool will be reduced.

Education of Personnel

The first step in the training of mechanics is our apprentice program. During apprenticeship the prospective mechanic is thoroughly instructed in the fundamentals of his trade. With the constant developments being made in machines and machining methods it is necessary that the training and education be carried on continuously and for this reason we recently undertook a visual aid program, consisting of motion pictures of various shop operations.

Two pictures, made at Sacramento general shops, are entitled "Processing and Use of Machine Tools" and "Machine Cutting Tools—Their Selection and Application."

The first picture covers the manufacture of machine tools and their application in the machining of car axles and wheels. The various steps in the manufacture are shown, from drafting room to blacksmith shop where the shanks are forged and high-speed steel or carbide tips are applied, and to the tool room where they are ground and tested. Following this, the necessary operations in preparing axles and wheels for mounting are shown, including proper use and care of the tools and machines, machine speeds and feeds, etc.

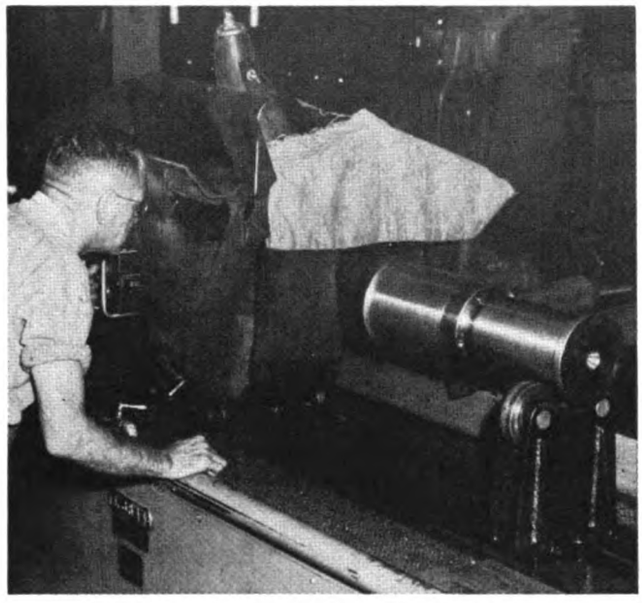
The second picture deals with tool design and maintenance, selection of the proper tool for a given job, and selection of the correct machine speeds and feeds for the job using the selected tool. The results of improper grinding of tools and of poor selection and application on both the tool and the work are shown.

The pictures have been shown to supervisors and mechanics at various shops on our system and have also been shown to personnel of other railroads, and were shown at the Locomotive Maintenance Officers' Association convention held at Chicago last September. The reception indicates that there is a definite need for this type of visual aid training. We hope, in the future, to make additional visual aid pictures of other phases of shop practice for the education of our employees.

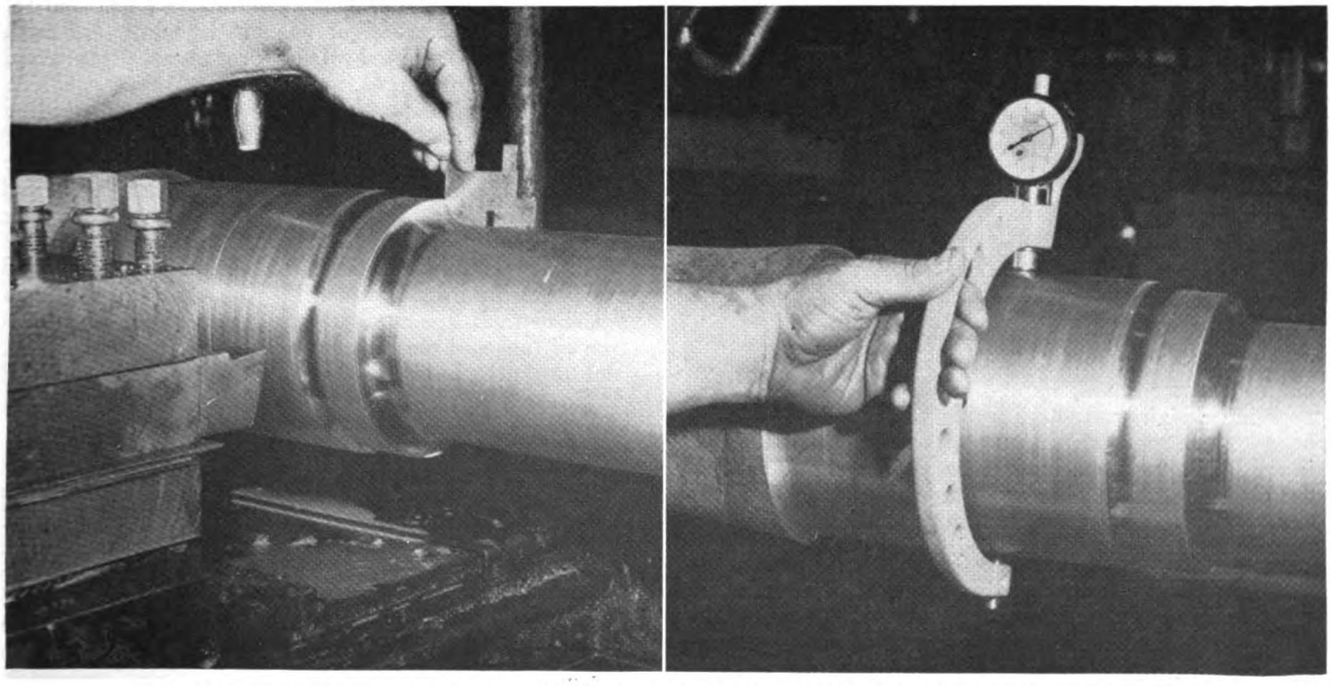
Cutting Tool Manufacture

Tool design is the foundation for proper cutting tools. Competent draftsmen with necessary experience, in conjunction with tool room personnel, design our tools. All plans are standardized and are placed in our standard tool folio. Tools are ordered by tool folio plan numbers and those manufactured at Sacramento are distributed over the system.

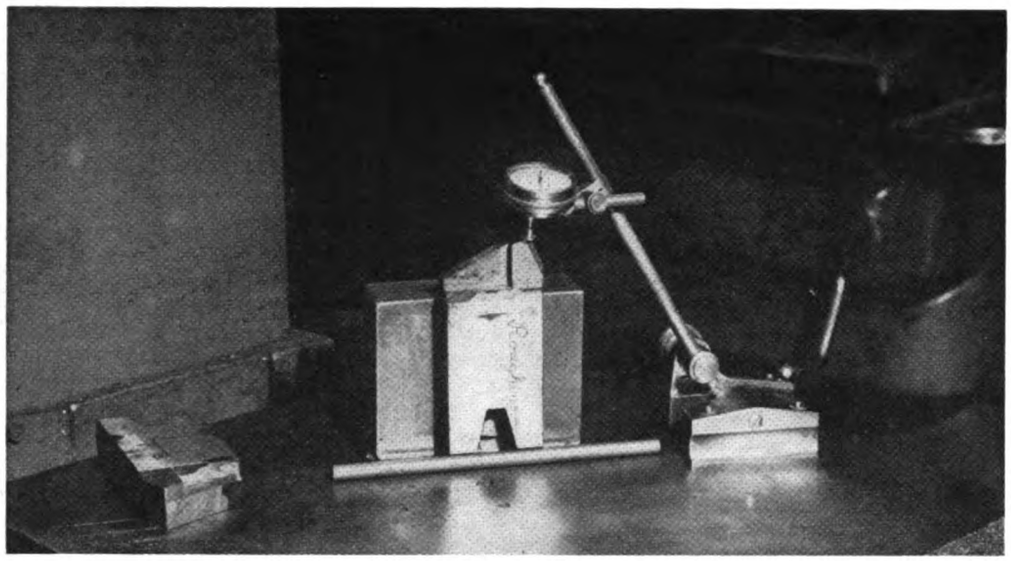
When a new tool is to be manufactured, the first step



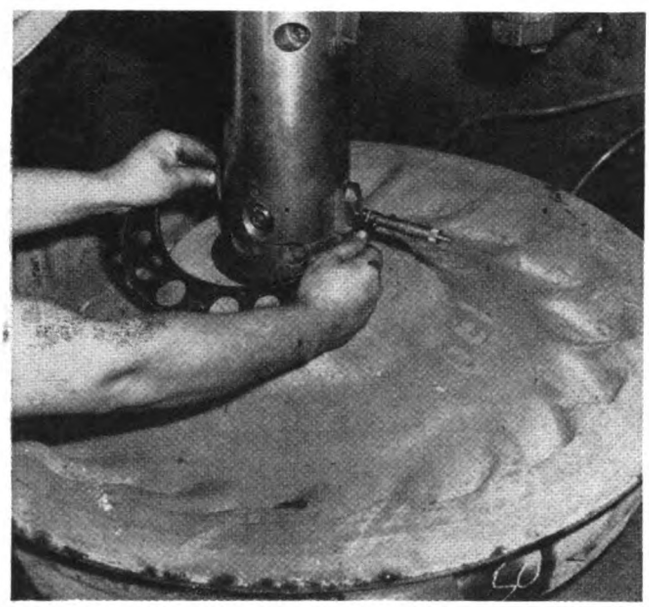
Equipment for the Magnaglo testing of axles



Left: The radius check gage in use. Right: Dial micrometer used for checking wheel seat diameter



Method of matching Davis boring-bar tools for correct length



Sizing of Davis boring-bar tools for finish boring

is the forming of the shank. This is made from locomotive tire steel, which is reclaimed by the stores department. The steel is heated to 2,250 deg. F. and re-formed into a rough tool shank by a 1,200-lb. steam hammer. The shank is then measured and cut on an anvil to the proper length.

From the toolsmiths the shank goes to the toolmakers, where a shaping machine is used to form a shelf on the cutting end for the high speed or carbide steel tip. When applying a high speed steel tip, flux is placed on the shelf of the shank, the tip is carefully positioned and more flux is applied to assure a uniform weld. The shank and tip are placed in the number one—pre-heat oven and heated to 1,550 deg. F. They are next moved to the second oven where they are heated to 2,375 deg. F., which is required to fuse the metals to form a satisfactory weld. From the high heat oven the metals are taken to the tipping press, where the tool tip is carefully pressed to the tool shank shelf. The final operation is to place the tool in an oil tempering bath, and after cooling git iis moved to the tool shop for finishing.

When brazing a carbide steel tip to a tool shank, flux is first applied to the shank and tip together with silver solder, the brazing medium, and the tip is then positioned. A torch is adjusted to produce a non-oxidizing flame and is applied to the bottom of the shank with continuous motion. The flame is also applied to the sides and some on the top. When the silver solder melts, the flame is removed and the tip is held firmly in place until the braze sets and cools.

Correct Grinding Highly Important

In the tool shop, where the final grinding of tool tips is performed, it is of the utmost importance that tool folio plans be understood and adhered to, as the tools must be precise to meet the rigid duty imposed upon them. The tool radii and cutting angles must be correct.

Carbide tools are ground to shape on a carbide tool grinding machine. Carborundum or crystalon grinding wheels for rough grinding a wheel of sixty grit and for finish grinding a wheel of one hundred grit, are used. These specially selected wheels are very soft to avoid setting up heat fractures.

Davis boring bar tools are put through two grinding machines, the first for grinding the cutting edges, and the second for grinding the chip breaker. These tools are ground anad matched in pairs. The size must be exact and the dimension from base to cutting edge is carefully checked with a dial indicator gauge.

All tools manufactured at Sacramento must be tested for Brinnell hardness as specified on the tool folio plan. Finished tools are numbered and lettered for identification of tool and machine on which they are to be used, and are distributed through the shops with the tool service wagon.

Machining Car Axles

Worn wheel and axle assemblies are shipped to Sacramento shops for replacement. Wheels are demounted and scrapped and axles, after being inspected and classified, are sandblasted to remove grease, dirt, paint and scale accumulated in service and are returned to the shop.

The first step in processing an axle is re-centering. The operator carefully fits a reamer attachment over the journal in a position to locate and bore an accurate center. The axle is then placed on the main axle rack.

From the rack the axle is removed to the axle lathe by a special type lifting-arm which supports it in balance while it is being placed between the lathe centers. The machinist hones any feather edges left on the tool before positioning it in the four-way block. The tool is set with the cutting edge $\frac{1}{32}$ in. above the axle center line. The machine controls are then set for correct speed and feed. The carbide cutting tools operate efficiently at a cutting speed of 200 surface f.p.m., and when machining a 7-in. diameter wheel seat the correct speed is 100 r.p.m. with $\frac{1}{32}$-in. feed.

A light cut is first made on the collar end of the journal, and only enough metal is removed to clean up the out-of-roundness. The tool is moved slowly toward the collar, with the machine operating at normal speed. The machine is then reduced to a jogging speed in order to produce a highly polished surface on the collar fillet. The jogging speed is also used when machining the $\frac{3}{4}$-in. fillet on the dust guard end of the journal. The final finish of the journal area, produced by a burnishing lathe, matches the polished radii at either end of the journal.

Wheel seats are turned to one of four standard sizes ranging from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. under the new wheel seat diameter. This is done to reduce re-setting of wheel boring tools.

All fillets are carefully checked with a fillet gauge and a dial micrometer is used to check the wheel seat size.

The final step is a Magnaflux or Magnaglo test to determine whether the axle has any internal fissures or surface fractures. The axle is then returned to the axle rack, where the lead machinist measures the wheel seats, marks the sizes on the axle and makes a record for distribution to the boring mill operators.

Chilled iron wheels, which are manufactured in the foundry at Sacramento, are placed in the boring mill using a modern electrically operated hoist and are centralized in the machine with an automatic chucking device.

The carbide tools used for the roughing cut are set to a diameter approximately .050 in. smaller than the finished size. They are perfectly matched to produce a straight and round bore. The middle bar tools are set, making proper allowance for pressure fit, from the list of sizes furnished the operator by the lead machinist. Above these finishing tools is the single fillet tool used to form a radius on the edge of the wheel bore, which enables the wheel to properly position itself when being press mounted on the axle.

The machine is operated at speed of 95 r.p.m. for the roughing cut, using a feed of 10½ in. per min. For the finishing cut the same speed is used, but feed is increased to 14¾ in. per min.

The finished wheel is then removed from the boring mill and moved to the mounting press.

Mounting Cast and Steel Wheels

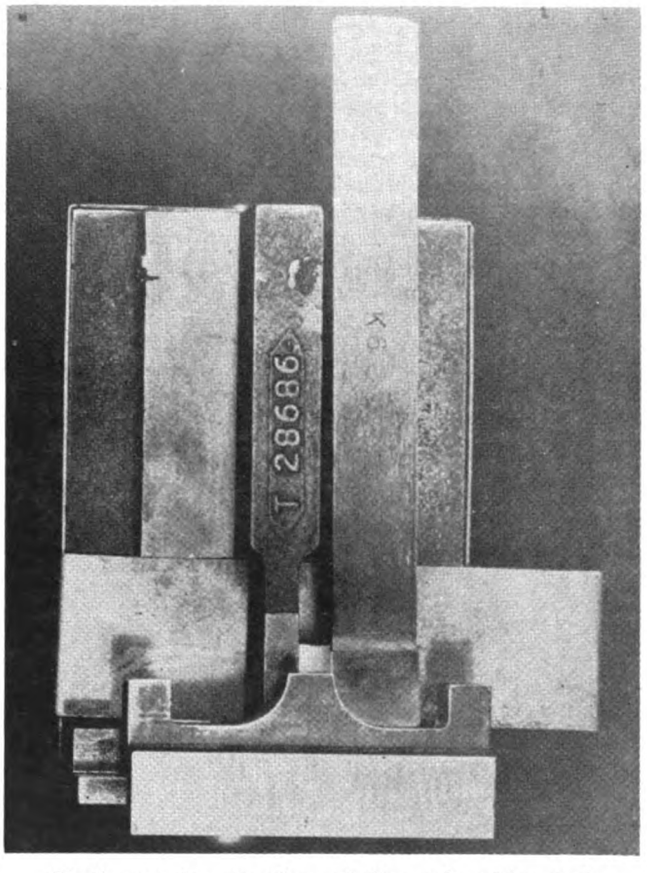
The hydraulic mounting press is located at the out-bound end of the wheel shop, in direct line with out-bound wheel storage or shipping tracks. The press is equipped with a gauge, which should register between 45 and 70 tons when cast iron wheels are being mounted. The pressure is also recorded on a paper tape with other identifying data.

After the wheels are mounted on the axles, final approval of the assembly must be given by the inspector. Following this approval, paint is applied to the highly finished journals to provide protection from the elements during shipment and until the wheel assemblies are applied under cars. The entire journal surface as well as the axle end is painted.

The final operation is loading the wheel assemblies on special wheel cars for distribution to various points on the system.



Honing tool to remove all feather edges after grinding for longer tool life



Check gage for use when grinding axle-cutting tools

By Dave Andrews

Our First Diesel

THE fact that most railroads were rapidly changing from steam to diesel power was not unknown to the employees and management of our small northern railroad. However, we all felt, "it can't happen here."

We couldn't visualize anything except a chugging steam engine hauling a string of freight cars through the foothills and past the lakes and streams of this wilderness country. However, rising costs of steam maintainance plus the ever-increasing difficulty of getting parts for the rapidly disappearing iron horse exerted pressure on a road needing new power—this little road certainly needed some new power.

One day about a year ago, a group of influential looking men walked through our shop and into the office. Then the rumors started. Fire cleaners, hostlers, boilermakers or blacksmiths all could give you the lowdown—those guys were diesel men. Strangely enough they were right and "those guys," spent the next few days making a survey of our diesel requirements right down to the last oil filter and brake shoe.

Mechanical department employees are but little interested in the kind or type of locomotives used by their employer. Whether it is steam or diesel matters but little, it has to be maintained and that is their job. On small railroads the picture changes, the railroad is in the workers blood. In a small town everyone knows everyone else's business and the railroad is a way of life to them. On a short line road serving a farming community most of the help comes right out of school. Their fathers before them were railroaders and if the road continues to run their sons and grandsons will probably be railroaders too. To these men diesel power could be catastrophic. One of the major economies of diesel power is maintainance cost and that means less man power.

Some months after the visit of the diesel men it became obvious that something was in the wind and what had heretofore been a mere topic of conversation now became a sharp tool to deepen the grooves in many foreheads. Everyone took his seat on the anxious bench and proceeded to wonder how secure his job was.

Some of the non-believers pooh-poohed the idea saying, "where would a railroad that can't pay standard wages get the money to buy diesels." How wrong they were was soon to be demonstrated for one morning when the men came to work there was a new shiny 1,600-hp. road switcher straddling a pit as comfortably as if it had been there for years. One sure way of drawing a wide eyed and curious crowd is to move a diesel into a steam shop. This one was no exception. By the time the starting whistle blew the men were standng six deep all around it and the foremen had a tough time to get them to work. Even then, work was done between peeks at the sleek monster on No. 2 pit.

Soon a group of service men appeared in work clothes and the initial servicing of a diesel demonstrator began. I won't bore you with all the details of inspecting traction motors and suspension bearings and all of the myriad of major and minor operations needed to ready a locomotive for service. Enough to say, by nightfall we had gone through our indoctrination period in diesel inspection and repair and the unit was ready for service.

The next morning our first diesel was ready to make a test run with a full tonnage train to our northern terminal, there to couple on to the other side of this freight job and back again. This run takes about 24 hours. When the train pulled out of town the diesel cab was so crowded with men that it looked like a rush-hour street car.

The ensuing days found the unit performing as a good diesel should, covering the road in good time with full tonnage trains against adverse weather conditions with a minimum of fuel consumption. With the exception of adding lube oil, changing an occasional brake shoe and adjusting the sanders we had little to do with the unit mechanically. In fact, we in the shop marveled at the small amount of repair work needed to keep this type of locomotive in service. However, this myth about no work on a diesel was soon to explode around our heads like a miniature atom bomb, because when the unit returned from the northern run it was discovered that one of the motor suspension bearings was running hot. The unit was immediately brought into the shop where a more thorough inspection could be made. This inspection verified our deepest fears, the bearing was completely ruined.

We turned to the service man who was with us at the time and asked, "What do we do now?" We sure were babes in the wood when it came to repairing this outfit. He replied that there was nothing to do but remove the traction motor and wheels and replace it with a new assembly. By this time it was four o'clock in the afternoon and he had to hurry to the office to call his boss and make arrangements for a new assembly to be shipped to our shop. After a lengthy telephone conversation he appeared with the information that there would be a new outfit shipped by truck to arrive at the shop at four a.m. the next day. "And now," he said, "all we have to do is take the old one out." He might just as well have told us to push the *Queen Mary* away from its dock with a hand full of broom straws. I suppose the poor fellow thought ti himself, "what a dumb bunch of so-called mechanics." I don't know that we ever exonerated ourselves but we certainly worked hard enough trying.

This lad knew what had to be done, but how it was to be done in a shop with no diesel facilities was something entirely different. We knew, naturally, that it had to be over a drop pit so we moved the engine over our standard pit for removing one pair of steam locomotive drivers. Common sense told us it had to be jacked and blocked so we did that. Now the actual removal of the traction motor unit began. We had disconnected the power cables and the brake rigging and put some small horseshoes in the spring next to hold the tension on the springs of the nose suspension. Next, we jacked and blocked the equalizers and removed the spring nest. Our pit is equipped with the usual hydraulic jack with the standard cap on the top

of the ram made to accommodate a locomotive driving axle.

If you ever care to see a useless piece of apparatus, gaze up at the bottom of a traction motor and then at a standard pit jack and try to find a place to jack against solid and secure enough to drop a six-ton assembly the three feet needed to get it out from under a diesel. I never felt so utterly defeated. After much looking and sifting out of ideas we placed a 30-in. length of 80-lb. rail under the heads of the suspension bearing cap bolts and with the rail hitting on the top of the ram cap we took a little strain on the assembly. Luckily it held and raised the truck sufficiently to block the equalizers and hold them in position. Everything was ready now with the exception of removing the safety straps or binders, as we insisted on calling them.

This done, the actual lowering was about to begin. We all got into the clear and, operating the jack with a lever long enough to give us sort of a remote control, we let it down a few inches. Far enough to discover that we had still another condition to combat, namely, the overhang of the motor fingers over the truck frame. In other words we found that the motor could not come straight down, the back end would have to be raised and then the entire assembly dropped at an acute angle. This required more study with the final solution being to crib up in under the back side of the traction motor and with a 35-ton journal jack raise the rear of the motor about four inches. We had the assembly in the proper position to lower but now instead of one jack to manipulate there were two. Holding our breath while this heavy and awkward unit teetered precariously on its improvised support we let it down about three inches. We had to block and crib our stubborn baby and reset the jacks so we could lower it a few inches more. This went on for hours and at 3 a.m. it was down far enough to clear the pedestals.

To slide this mass of steel and copper out from under the locomotive was our next problem. Again we carried blocking until the entire drop pit was a giant crib and our backs were numb with lugging heavy wooden timbers through a dimly lighted shop where we continually barked our shins against outcropping pipes, bars and parts of locomotives. A snatch block was anchored in one end of the pit and a cable stretched from the overhead crane through the sheave and one end fastened to the motor. We gave the craneman a lift signal and slowly the motor skidded out from under the locomotive. Soon it was exposed enough to fasten the crane into the lifting eyes on the motor, then it was a short job to set it out on the floor, finally safe and secure. It was now 4 a.m. and we were a tired and greasy bunch of men but satisfied that we had accomplished a job that 12 hours previous had seemed utterly impossible.

Installing a new assembly was mere child's play for now we were acquainted with our problem and could go about it in a business-like manner.

The new parts came separately and had to be assembled. While this was being done we made a cradle out of some 6-in. by 10-in. oak timbers long enough to reach under the locomotive with a foot or so of the cradle exposed on each side of the running board. This was wide enough to accommodate the traction motor assembly safely. The cradle was dropped into the pit by the shop crane and placed on several 3-in. pipe rollers, in the center of which we placed two short pieces of 80-lb. rail about 2 ft. apart. On the back end of these we secured a 4-in. block of hard wood to establish an angle so that additional jacking once the unit was up in place would not be necessary. The new motor and wheels were dropped down onto the cradle with the back side of the motor on the block. A spreader with suitable cables was dropped down alongside the locomotive and fastened to the cradle taking care to have lift enough to raise the unit up into the jaws. When all was in readiness we gave the craneman the high sign and in a matter of minutes the assembly was in place. The safety straps were applied, the cradle removed and it was a brief chore to raise the unit and replace the rails. Connecting the power cable and replacing the brake rigging was a short job and our first diesel was again ready for service.

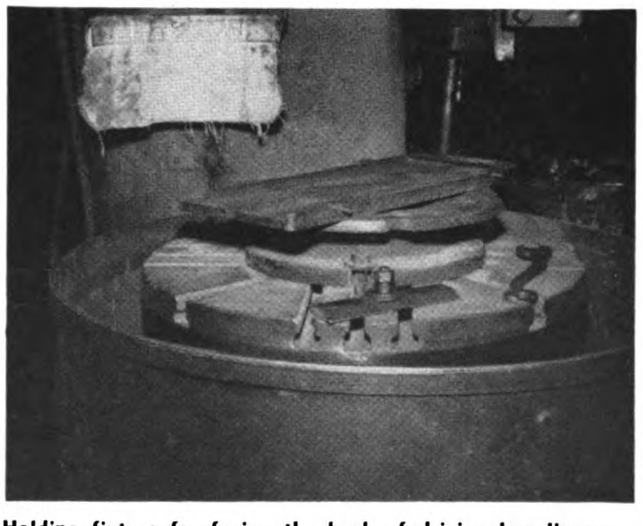
We had replaced an assembly in about three hours that had taken us twelve to remove. Believe me we won't take so long or work so hard next time.

Increasing Life of Driving Box Liners

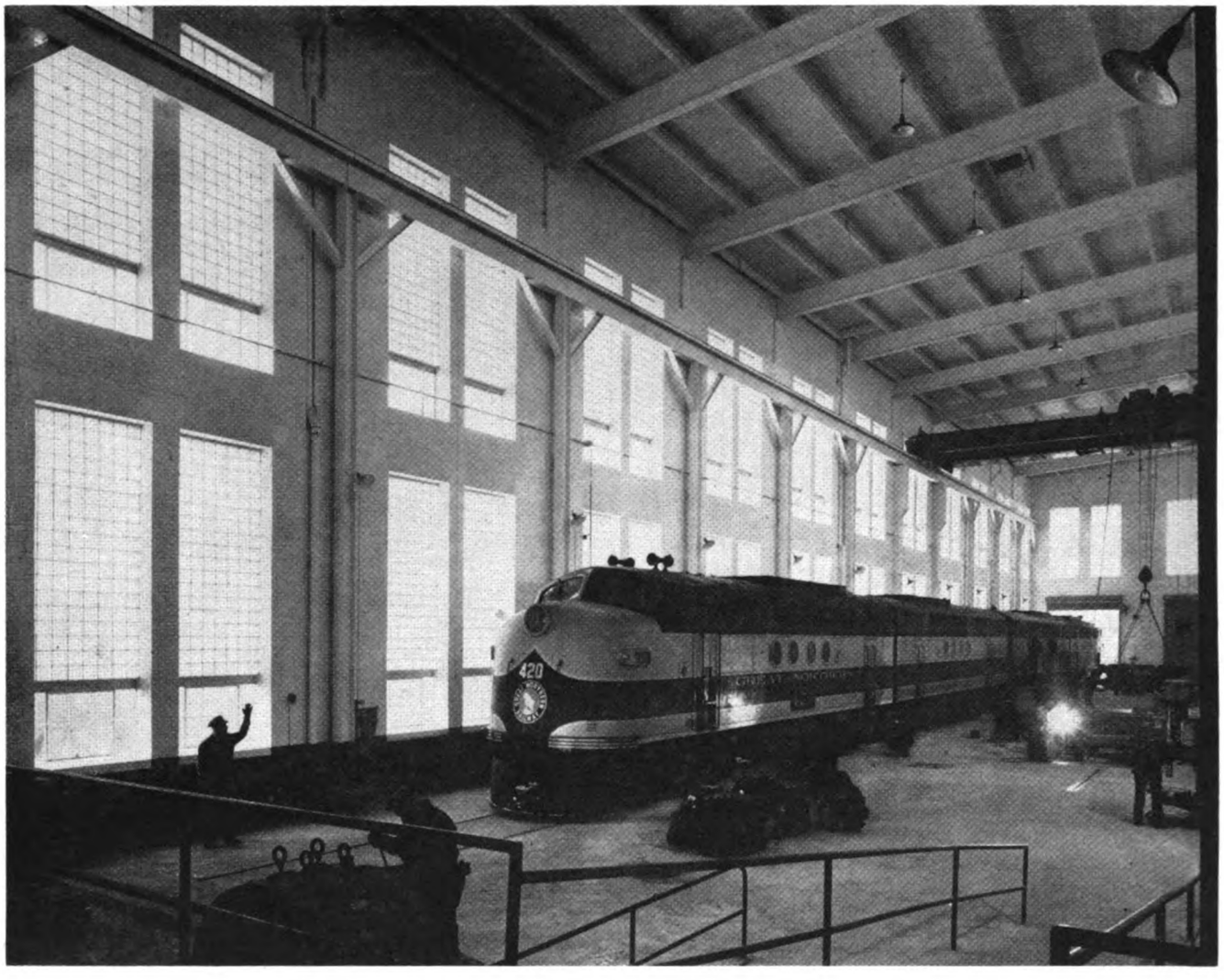
The Battle Creek, Mich., shops of the Grand Trunk Western has increased the life of driving box shoe and wedge face liners by facing the back of the liner. The facing lengthens liner life by reducing the tendency for the liners to work loose.

The shoe and wedge cast brass liners, for application to the faces of boxes, are faced on a boring mill equipped with a special holding fixture that is readily applied or removed. Two clamps and four set screws secure the liner in place, with the setup time taking about a minute. One clamp is removed and the liner slipped under the second clamp, which is tightened. The second clamp is then slipped over the liner and tightened in place. Both clamps have a nut and long bolt which slides in a slot at the end of the holding fixture, and are tapered to mate with the taper of the liner. The four set screws take up side play.

The holding fixture is fastened to a second holding fixture; the latter is permanently mounted on the boring mill for machining hub face liners. The backs of these liners are also faced to increase the wear life.



Holding fixture for facing the back of driving box liners—The liner slips under the clamp at the far end, after which the clamp lying on the table is placed over the near end of the liner—The small set screws take up side play



This installment of a discussion of requirements for maintenance facilities for diesel locomotives deals with the conversion of shops and enginehouses

Facilities for Diesel Repairs

*By R. H. Herman**

Small Maintenance Shop

The smallest facility would be one required for periodic maintenance of one or more Diesel switcher locomotives in a yard, terminal area or on a branch line. It is not practical to provide elaborate facilities for only a few locomotives and all heavy work would be performed at another shop or equipment returned to the manufacturer or a service shop for attention.

It is common practice to partition off two or more stalls in an enginehouse from the steam locomotive section for Diesel maintenance work. Yard switchers are normally brought into the shop once a month for I. C. C. inspection, requiring approximately eight hours, at which time progressive maintenance work is performed. Daily inspections can usually be made on an outside track between shifts. Road switchers are usually operated and maintained on a mileage or time schedule and may be brought once a week or oftener for maintenance.

The conventional depressed floor and platform arrangement in such a small shop is not economically justified for a few locomotives, however, stationary or movable platforms at running board level are very desirable. Machinery and equipment is limited and generally comprises only a small drill press, emery grinder, high voltage test set, valve seat and face grinders, equipment for filter and parts cleaning, test meters, gauges, wrenches and hand tools.

Fuel oil storage, pumping and disbursing and sanding facilities are essential. Lubricating oil for change or makeup can be supplied from drums and water from existing services. Sand may be obtained from the spout or connection at an existing steam locomotive coal chute.

It is generally necessary that some means be provided for changing wheels or traction motors since considerable service time would be lost and expense involved in moving the switcher locomotive to another shop for such work. New drop table facilities are not economically justified for a few wheel changes a year, however, if a steam locomotive drop table is available it can be used to good advantage. It is possible to change wheels using pneumatic jacks to raise the cab, blocking and alternately lifting one end and then the other until truck can be released. After the truck is removed an existing hoist, crane or even a wrecking derrick can be used to raise the truck and release a pair of wheels. This method is slow and costly and only justified where a few pair of wheels must be changed.

Branch Line Maintenance Shop

A slightly larger progressive maintenance shop would be required to handle periodic inspection and maintenance work on six or more Diesel road switchers operating in branch line service. In a shop of this type it is probable that depressed floors and platforms would not be justified since satisfactory work can be performed from movable platforms at running board level.

A satisfactory arrangement can be installed in a roundhouse or preferably in a rectangular building, if available for conversion. At least one inspection pit should be provided inside the building long enough for a Diesel locomotive unit, together with space for office, wash and locker rooms, toilets, storehouse and work space for filters and parts. Motor driven exhaust ventilators or equivalent means for removing fumes from the building are a necessity.

Since a number of wheel changes will be required each month, some means should be available for this purpose. A transfer table or drop table for either single pair of wheels or truck is very satisfactory but relatively costly. For such an application, four 35- or 50-ton electrically-operated portable jacks are a satisfactory substitute at a lower initial cost. The four jacks are operated in unison to raise the locomotive cab and the truck is rolled out endwise. An existing hoist or crane of 5-tons or greater capacity, or a new crane, can then be used to remove wheels and motor from the truck.

The crane would also be available for loading and unloading wheels, motors and other heavy parts and, if of 10-ton or greater capacity, it can be used to lift out a Diesel engine after it has been stripped down to within the capacity of the crane. Normally it should not be necessary to remove the engine or do heavy repairs at such a relatively small shop.

The facilities outside the building should include fuel oil storage, pumping and disbursing systems, sanding arrangement and a wash track. If the locomotives arrive in the shop area at frequent intervals for turnaround inspection an outside inspection pit is a very desirable feature.

As the number of locomotives to be maintained at a given shop approach 30 or more, depressed floors and platforms are justified from the standpoint of ease and economy in maintenance. A greater amount of floor space is required for parts reconditioning work, filter cleaning, wheel and motor storage, storehouse, wash and locker rooms as well as space for overhaul of batteries, radiator cooler cores, and even Diesel engines.

A wide variety of shops for this purpose have been built and placed in operation by Diesel railroads ranging from complete new shop facilities of the conventional rectangular design to inspection pit tracks in a steam locomotive erecting shop, machine shop or even in a roundhouse. In the early days of Diesel operation, planning was principally on the basis of new shop facilities of rectangular design with depressed floors, platforms and servicing facilities. This procedure was usually necessary at that time because of the need for existing facilities to handle steam locomotive work. More and more Diesel-electric locomotives are being purchased and it is not difficult to foresee the day when divisions or railroads will be completely Dieselized. Heavy repair shops, roundhouses and numerous shop buildings will not be needed in the future for steam locomotive work, and if not utilized for other purposes must be retired and dismantled.

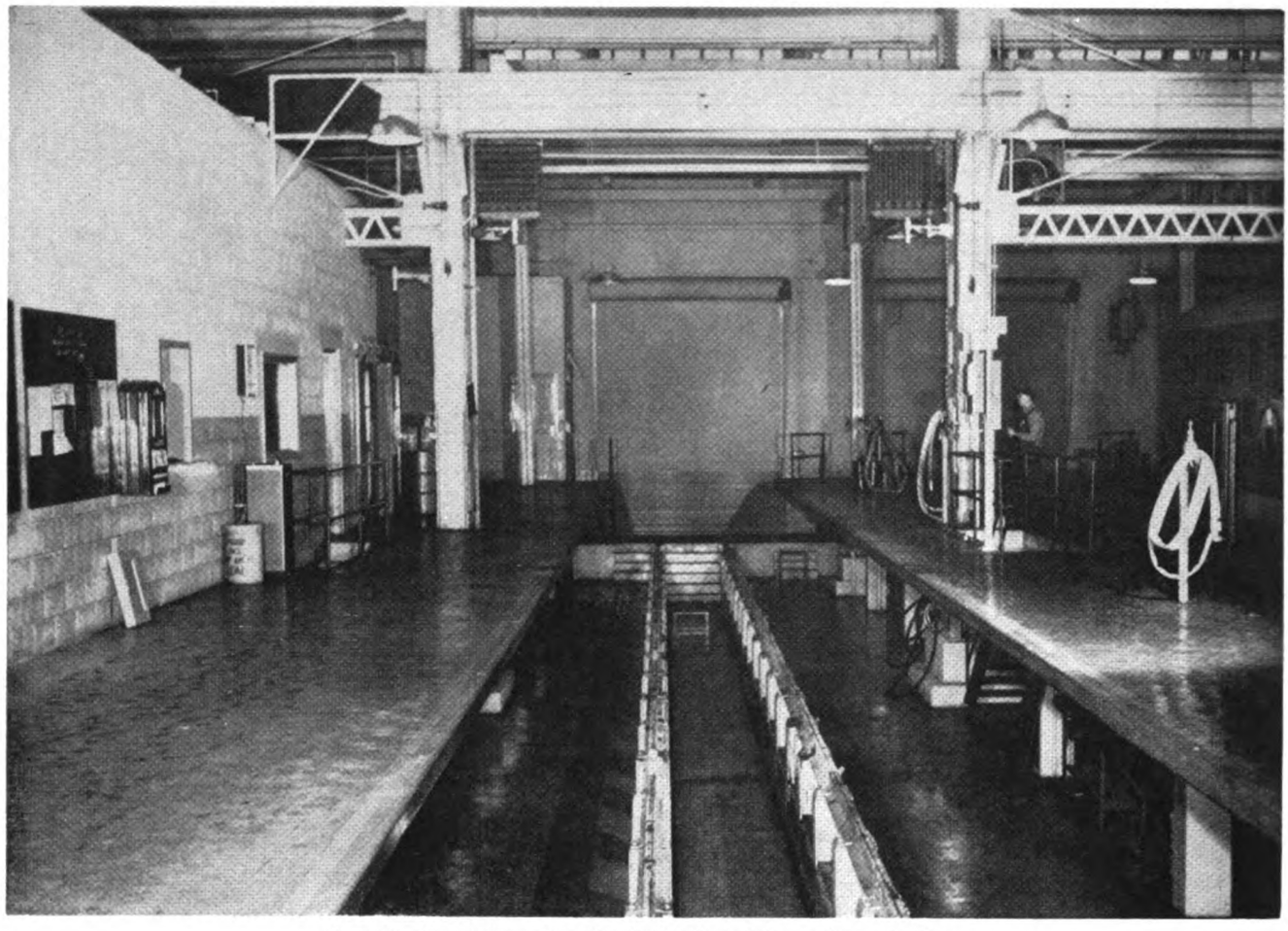
There is a most important question of economics involved and it is obvious that railroad managements cannot afford to make the large expenditures required for completely new buildings for Diesel maintenance work and ultimately to retire practically all the structures formerly used for steam locomotives. It is possible to provide satisfactory and efficient maintenance facilities in an existing building or even a roundhouse at a cost only one-third the cost of a complete new shop.

It is essential that full consideration be given to the conversion or alteration of existing buildings before a decision is made to construct a completely new shop.

New or Converted Maintenance Shops

Progressive maintenance shops, either new or converted are usually provided with one or more full length

* Engineer Shops and Equipment, Southern Railway System



Interior of a modern three-level diesel servicing and repair shop

pressed floors and platforms. A drop table is installed, either for single pair of wheels or complete truck with a release track and work area for wheels, motors and trucks. The parts reconditioning room, filter cleaning room, offices and storehouse are usually placed at the end of the stub tracks. It is desirable to have these areas on the platform level, utilizing the area underneath for additional storage, battery overhaul or wash and locker rooms. Such an arrangement has proved very satisfactory as a basic design and a large number of shops have been constructed on this pattern.

An overhead traveling crane is usually provided, spanning one service and the wheel release track and traveling the length of the building or operating crosswise over the drop pit and covering portions of the wheel release and service tracks. If traction motors and wheels represent the heaviest equipment to be handled, a 5-ton crane is adequate. Normally a 7½-ton crane can be installed at slightly greater cost to handle main generators, steam heat generators and other heavy parts into and out of the locomotive. If Diesel engines are to be removed and overhauled a crane of 30-ton capacity, with 5- to 10-ton auxiliary hoist, is essential.

A shop of any appreciable size should be equipped with pipe systems for disbursing both lubricating oil and treated water for engine cooling system direct to the locomotive by hose, eliminating costly barrel handling. The lube oil system should include storage tanks for lube oil, pumps and piping to convenient points on the platform as well as a similar arrangement to remove and return used lube oil from the engine to a dirty lube oil storage tank.

The high cost of water treatment in Diesel engine cooling systems makes it desirable to salvage and reuse the engine cooling water, when necessary to remove it for engine work. Two pipe systems are provided, with pumps and storage tanks, one to distribute the water to suitable locations on the platforms and the other for return of water drained from the cooling system.

The ventilation of the shop building is very important for the removal of fumes. Early Diesel shops were provided with jacks or hoods to remove fumes but it is now general practice to use motor driven exhaust ventilators, with chain or motor operated dampers, for this purpose.

Converted Boiler Shop

There are numerous variations of this arrangement where existing buildings were converted for progressive maintenance work, all of which form efficient arrangements. In one case two inspection pits were installed in a boiler shop, adjacent to a large erecting shop, for four-unit freight locomotives. Instead of depressing the floor the top of the rail on inspection pits was placed 2 ft. 9 in. above floor level, with a grade in the track outside the building. This reduced the cost since it was only neces-

sary to remove the floor for the pits themselves. Platforms were constructed between and outside the tracks with a cross platform at the stub end providing sufficient space on the upper level for parts reconditioning and filter cleaning.

The top of the working platform is at cab floor height and 7 ft. 4 in. above shop floor level. This feature necessitated long ramps, steps and considerable travel time but has not proven to be objectionable.

Converted Erecting Shops

A number of erecting shops on different railroads have been converted for progressive maintenance work by installing new or extending existing inspection pits to provide space for one or more Diesel locomotives in the shop. Floors are generally depressed and working platforms provided at cab floor level. In some cases space is provided on the platforms for parts reconditioning and filter cleaning but usually such work can be handled in the machine shop area, under or on balconies or at some convenient section in the building.

An erecting shop with parallel or transverse tracks in the erecting bay is most satisfactory for such a conversion; however, an efficient arrangement can also be provided in a longitudinal shop.

Converted Enginehouses

It is entirely possible to convert a steam locomotive roundhouse into a progressive maintenance shop for Diesel locomotives and several successful installations have recently been placed in service. In two cases the roundhouses were of reinforced concrete construction, in good condition and no longer required for steam locomotive work. The existing inspection pits were only long enough for one Diesel locomotive unit and too shallow for satisfactory inspection and maintenance, since they varied in depth from 2 ft. 10 in. at one end to 3 ft. 2 in. at the drain.

Conversion work consisted of the construction of a 24-ft. brick and concrete extension on the outside circle of the roundhouse with the inspection pits extended to a total length of 103 ft. The new portion of the pit was 4 ft. 6 in. deep between rails and it was found that the old portion could be deepened by removing the original concrete floor and pouring a new slab to provide a minimum depth of 4 ft. 6 in. in the entire inspection pit. It should be noted that inspection pits in modern Diesel shops are generally constructed with a depth of 4 ft. minimum from the top of rail, with the floor graded for drainage. With a deeper pit, as mentioned above, ledges are usually desirable in side walls above the pit floor to support boards or platforms for working on the upper part of the trucks.

The old floor in the roundhouse was removed and a new depressed floor installed over the entire area of the 24 ft. extension and around the ends of the pits, but it extends over only two-thirds of the original area in the roundhouse to keep costs to a minimum. Working platforms of tongue and groove planking on steel frame and columns were installed over the entire depressed floor.

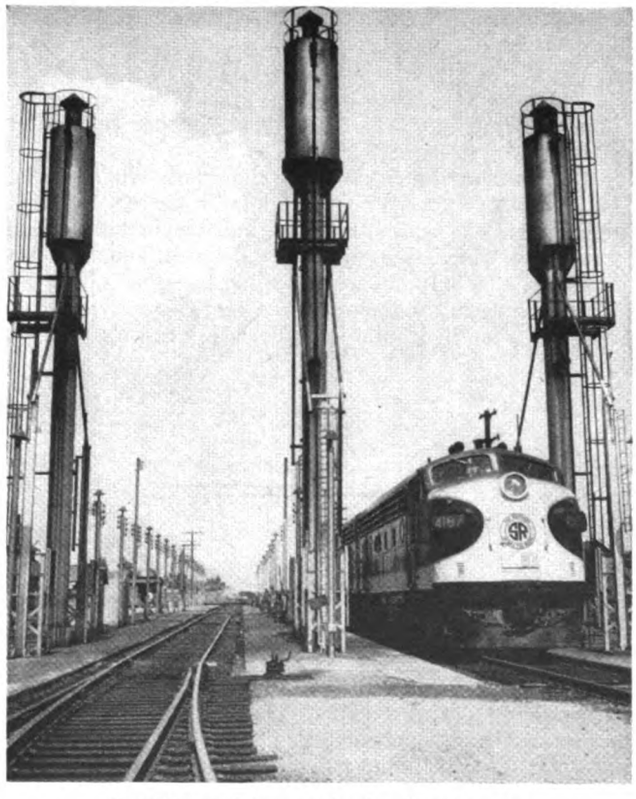
These roundhouses were designed primarily for the maintenance of Diesel-electric freight locomotive units and the platforms extend only 70 ft. along the 103 ft. length of the inspection pit, which is sufficient to reach all three doors in the cabs of an "A" and "B" freight unit backed into the roundhouse. This is not a serious inconvenience and reduces the initial cost as compared to depressed floors and platforms the full length of the inspection pits.

The number of roundhouse stalls to be converted will depend upon the number of locomotive units to be handled. Eight stalls were converted in one roundhouse and six in the other, providing space for two freight units on each track or a total of 16 and 12 units respectively for maintenance work in the shop at one time. As the requirements for Diesel locomotive work increase, with a corresponding decrease in the volume of steam locomotive work, additional stalks can be converted for Diesel repairs.

A drop table for a single pair of wheels is provided at each location serving two or three of the extended inspection pit tracks as well as one or more additional tracks used for wheel release and space for working wheels and motors. The floor at the wheel release track is at top of rail level and the stalls are not extended. Wheels, motors and other heavy parts are handled by a 5 or 10 ton overhead crane in the monitor section of the roundhouse.

The Diesel section of the roundhouse should be separated from the steam section to keep out dust and dirt. One or more stalls with the floor at top of rail level or platform level can also be partitioned off and used for parts reconditioning or filter cleaning work. A more satisfactory arrangement is to construct an addition to the building for this work. It could be in the form of an extension on the outside circle covering two or more stalls.

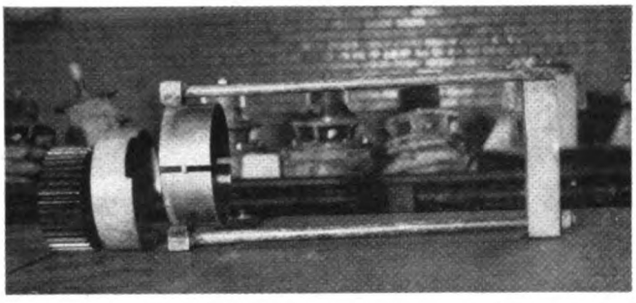
Progressive maintenance facilities in a converted erecting shop, roundhouse or steam locomotive shop can be designed and arranged to perform the work as efficiently as those in a large new repair shop. Cost will be reduced materially and while in some locations it may be necessary to do extra switching or to separate the locomotive into several sections such disadvantages are not serious.



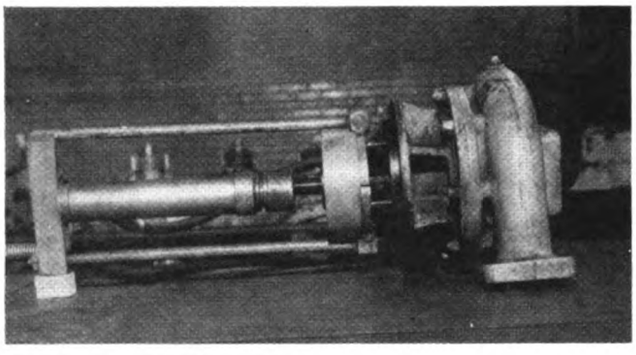
Outside servicing tracks for diesel power

Water Pump Gear Puller

The removal of water pump gears is simplified by a pulling arrangement which consists of a backing up piece, two long rods, an inner and an outer ring. The inner ring is split to permit placing it over the gear, and has an internal flange to contact the gear during the pulling operation.



The principal parts of the water-pump gear puller. The split inner ring held apart, shows its construction by two small pins which are not part of the puller



The puller in place for removing the water pump gear

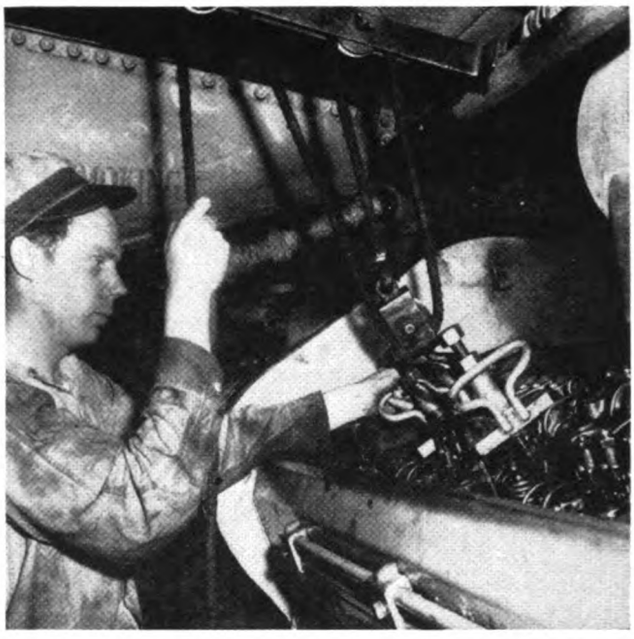
The combination section of the inner ring, the two long rods and the backing-up block is flexible to permit opening up the split inner ring and placing it over the gear. The outer ring slips over the split inner ring to hold the latter in place while pulling the gear off.

The pressure for removing the gears is exerted by the use of a 5-ton hydraulic jack which is hand operated.

Cylinder Assembly Puller

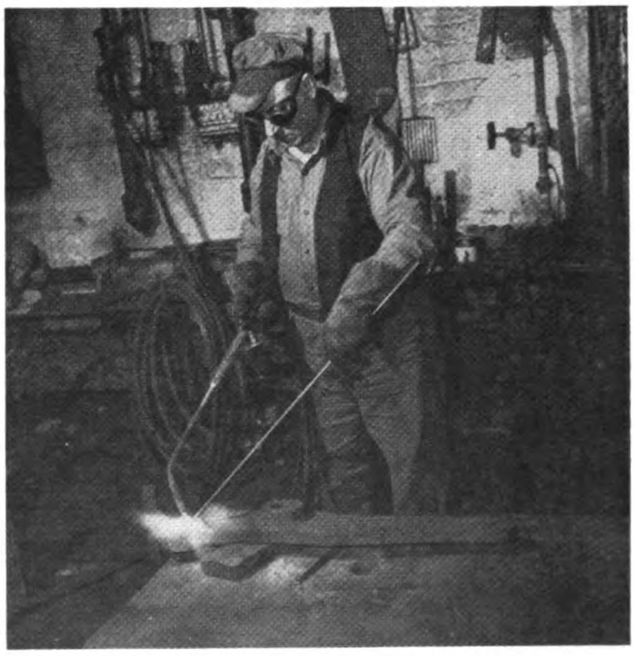
A device has been developed at the Spencer, N.C., shops of the Southern to simplify the pulling of heads, liners and pistons on E.M.D. locomotives. The main frame of the puller is in two parts hinged together. One part fits over the flange on which the radiator cool air baffle rests. The second part fits over a channel section under the radiator. During operation the puller is L-shaped with the first part of the frame vertical and the second horizontal.

The necessary leverage is attained by a three-pulley system, two on the horizontal section of the frame and one on the line. The pulleys on the frame are so applied that either may be removed easily to get at the No. 3 or 11 cylinder without interference from the shutter air cylinder. The removal is made easy by securing one end of the shaft with a wing nut.



The cylinder assembly puller in operation

* * *



Diesel brake rigging, badly worn from hard service, is repaired by oxyacetylene welding in a western rail road shop. When holes in the many types of levers become worn, they're rebuilt with steel welding rod. New holes are then drilled in the parts to new sleeves. Welding and drilling is done at a fraction of the cost of new parts.

Changes in 1951 Interchange Rules*

BECAUSE of continual changes in car construction, car service, interchange problems, methods of repairs, billing practices, and the ever fluctuating costs of labor and materials, etc., corresponding changes in the Rules and in the prices (charges) for repair materials and labor must be made from time to time as conditions warrant. These are bound to keep you alert and require steady and close attention in order to be up to date. No one person knows it all, each of us is continually learning from each other through associations of this kind, by direct contact and in other ways. Likewise, many of us make suggestions or recommendations for changes in the rules but never get away with them all.

Recommendations for changes in the rules, as you all know, are handled by the Arbitration Committee of the Association of American Railroads, Mechanical Division, the suggestions coming from the various other standing committees, from railroads, private car lines, associations like this one, etc. The prices are revised by the A.A.R., Committee on Labor and Materials by checking semi-annually in Spring and Fall, through quotations obtained from the purchasing agents of ten railroads representative of all sections of our country, including one Canadian road. Seven per cent stores expense, one per cent interest on stock investment and approximately one per cent for commercial and deadhead freight haul are added; see Interpretation No. 1 to Rule 105. These percentages are now being checked by a Joint Sub-Committee.

Labor rates are similarly checked, and to these averages are added percentages to cover overhead expenses, railroad retirement and unemployment insurance taxes and vacations with pay, as described in preface to Rule 107. All price revisions, including reproduction prices for destroyed cars, are also subject to approval by the Arbitration Committee. The private car lines are adequately represented on these committees.

Billing for car repairs is a very important and necessary part of our general subject and is greatly influenced by practically all the rules. If you have no idea as to what this totals for the country, I might state that the last survey by the A.A.R. covered the year 1939, the total for freight car repairs billed by railroads was about $30,853,696, excluding repairs to passenger equipment cars, repairs on defect cards, "No Bill" repairs, destroyed cars, and billing by private car lines. Of that total, $9,761,664, or 32 per cent was repairs to private line cars. The totals today would very considerably exceed these figures due to the large increases in subsequent labor and material prices, over 100 per cent each.

As further information and just to check on how the roads represented in the association treat our Pennsylvania freight cars, and vice versa, regarding repairs charged, allow me to present the following data covering the year 1950 (which figures do not include destroyed or dismantled cars):

We look forward to a reduction in bills against us, since we built several thousand new cars in the last few years, plus 10,000 new Pennsylvania and 10,000 Equitable cars this year, and retired 56,000 of our oldest cars during the last five years, and also have a very large program of heavy repairs and improvements to our other cars.

Now, in taking up the changes made in the rules effective January 1, 1951, I will not discuss to much extent those that were issued in Supplement No. 1 dated July, 1950, as you are well informed on same. Therefore, since important changes have been made they should be carefully studied and the requirements strictly followed. In addition to the Changes from 1950 Rules printed in front of the Rule book, attention is directed particularly to the following:

Rule 3

The effective dates of the following Sections have been extended to January 1, 1952:

Sec. (a-4)—Type AB brakes required on all cars, in interchange. This extension is account Order by Division 3 of the Interstate Commerce Commission issued on

* Abstract of a discussion of the changes in Interchange Rules presented before a meeting of the Eastern Car Foremen's Association, New York, February 9, 1951.

† General foreman, M.C.B. Clearing Housing, Pennsylvania.

TABLE I—CAR REPAIRS, SELECTED ROADS, YEAR 1950

Road	Repairs to P. R. R. freight cars: Total repairs	Per diem days	Repairs per car day	Repairs made by P. R. R.: Total repairs	Per diem days	Repairs per car day	Foreign roads exceeded repairs made by P. R. R.
B. & O.	$ 312,997	1,310,313	$0.238	$139,958	1,524,619	$0.098	$ 173,039
B. & M.	68,659	307,014	0.224	13,351	160,733	0.083	55,308
C. of N. J.	28,683	259,837	0.111	10,504	66,548	0.158	18,179
C. R. P.	43,320	101,735	0.426	31,419	293,911	0.107	11,901
D. & H.	226,385	395,095	0.573	40,914	458,439	0.089	185,471
D. L. & W.	163,158	469,182	0.348	41,340	496,228	0.083	121,818
Erie	163,027	616,688	0.264	58,048	669,260	0.087	104,979
L. V.	102,839	651,621	0.156	44,091	482,165	0.091	58,748
N. Y. C.	629,438	3,416,895	0.184	294,931	3,017,927	0.097	334,507
N. Y., N. H. & H.	133,997	576,175	0.233	23,634	310,563	0.076	110,363
Reading	252,189	921,947	0.274	101,041	1,044,503	0.097	151,148
Total	$2,124,692	9,026,502	$0.235	$799,231	8,524,896	$0.094	$1,325,461 or 0.141 per car day
Total defect cards	134,544			96,022			
Grand total	$2,259,236			$895,253			

October 10, 1950, which thus eliminates the second note under this Section (a-4) at top of page 17 of the 1950 Rules referring to I.C.C. Docket No. 13528 on this subject.

Sec. (a-6)—Air brake pipe clamps; *J* bolt type.

Sec. (a-7)—Air brake pipe clamps; *U* bolt type.

Sec. (b-7)—Metal badge plates (brake levers).

Sec. (b-9)—Required brake power percentages.

Sec. (c-11)—Old style couplers have 5 by 7 shank.

Sec. (c-12)—*E* type coupler, bottom rotary operated, not equipped with assembled riveted type lock lift lever and toggle.

Sec. (t-3-b)—Cast-steel truck side frames have *I*, *T* or *L* section compression or tension members.

Sec. (t-3-f)—Cast-steel truck side frames to which repair patches or reinforcing plates have been applied.

Sec. (u-4)—Non-acceptance of Class E-3 cars from owners. (New note added states no further extension will be granted.)

Sec. (b-2)—Modified to provide that air brake beams of not less than the capacity of the No. 2 plus beam are required on all cars in interchange.

Sec. (d-1), Third Note—Modified to indicate that requirement of this Note applies to other cars of special construction as well as to ore cars, and only to such cars built new or rebuilt on or after January 1, 1950.

Sec. (d-3), Note—Modified to clarify the intent that draft keys should *preferably* be applied from the brake pipe side of the center sills where *construction of car* will permit.

New Sec. (j-3)—Added to provide that empty cars with repack date more than 15 months old may be rejected from owners. See comments under Rule 66 relative to change in time limit for periodic repacking of journal boxes. Rule 66-a reduces the time limit for periodic repacking of friction journal boxes from 15 months to 12 months in an effort to improve lubrication performances of freight cars.

Sec. (r)—The complete "Specifications for Running Boards Other Than Wood, for Box Cars, Other Roofed Cars, and Tank Cars; for Brake Steps in Switching Service Including Their Tenders, auxiliary Power Units, or Ferry Idlers, If Any," following Paragraph (r-7) have been eliminated inasmuch as same are shown in Sec. C of the A.A.R. Manual of Standard and Recommended Practice. Reference to the latter was added to Paragraph (r-7).

Rule 4

Sec. (a) & (k)—A number of cases have been reported to the A.A.R. Secretary, of unnecessary delays to extensively damaged cars moving homeward for repairs, because defect cards attached fail to carry notation "Home for Repairs." Such cars are shopped by the road receiving same in interchange for checking to ascertain if all damage is fully covered by the defect cards. Invariably, additional unconcealed associated damage is found to exist, and the car is delayed while steps are being taken to procure additional defect card. In all cases of extensively damaged foreign cars being sent home on own wheels or loaded up, it is advisable to add this notation on the defect card issued, and also show date built, lightweight and Rule 112 class of car, in order to check that repairs billed do not exceed depreciated value less salvage.

Rule 9

A.A.R. couplers or parts thereof, R&R—Note modified to provide that when type *E*=11-in. face knuckle is applied separately, type of coupler repaired need not be shown. All other requirements are continued.

Journal boxes, friction bearings, periodic repacking, etc.—Modified to provide that purpose for which car was shopped must be shown if car is repacked prior to expiration of 12 instead of 15 months. This is due to change in Rule 66.

Brake Beams, R&R—New requirement effective August 1, 1950 to show "A.A.R. No. 18 and Certificate of Approval No. ," both of which are cast or marked on strut, of such beams—see Identification Table (Figure 2) under Rule 101 on page 213.

Brake Shoe Keys, applied—Requirement to show symbol *K-34* or *K-40* for A.A.R. Standard or Alternate Standard keys is eliminated, the repair card need only show *One (or more) brake shoe key* and the *Reason* for renewal.

Air Brakes Cleaned—Type AB-1 air brakes added, used mostly on head end passenger equipment cars but same cleaning period applies as under Freight Rule 60. Care must be taken to distinguish between types AB and AB-1-B brakes inasmuch as charge for COT&S, the latter is about 50 per cent higher than for AB brakes.

Rule 17

Sec. (e), Note 9—Modified to provide that where hanger type brake beams are substituted for hangerless type due to handling line responsibility, defect card should be issue for labor and material.

Sec. (L)—Modified to provide that extra heavy pipe (as well as fittings) may be substituted for single weight, or vice versa, as correct repairs; also, this provision now applies to hand rails on tank cars; material charges in all cases to be based on type of pipe or pipe fittings applied.

Sec. (s)—Modified to prohibit the substitution of A.A.R. Standard helical truck springs for long travel springs, or vice versa. Defect card for labor and material should be issued for improper substitution.

Rule 20

Figs. 2 & 3—Modified by eliminating requirement "where welding or riveting facilities are not available." Carrier iron shims covered by these figures may be applied without such restrictions.

Rule 23

Sec. B, New Item, Check Plates, Farlow—Added to prohibit welding same when section is broken out between key slots.

Item Coupler Locks—Modified to limit reclamation by welding to the building up of the depression where the lock has been worn by contact with the knuckle tail, and to eliminate permission to weld fractures in lock legs.

Item Journal Boxes (not integral)—Modified by dividing same into three sections, i.e., "Cast Steel—no restrictions"; "Malleable Iron—Bronze welding worn surfaces only" and "Cast Iron—no welding permitted."

Item Reservoirs, Auxiliary and Emergency Air Brake, Cast-Iron—Modified to provide for building up worn holes in lugs and bronze welding of lugs where fractured or broken off beyond ½-in. from body. No welding of body portion permitted.

Item Tanks of Tank Cars—Modified to permit welding of cracks or fractures in tanks of welded construction if all applicable requirements of I.C.C. Regulations for Transportation of Explosives and Other Dangerous Articles, and A.A.R. Specifications for Tank Cars, are fully complied with before such cars are restored to service.

Rule 30

Sec. B-1 table—Modified by making a separate item of *All-steel flat cars* and extending the subsequent reweighing period of same from 30 to 48 months. This is in accordance with revised Car Service Rule 11 approved by letter ballot of the Operating-Transportation Division and announced in Circular No. T-195, dated November 9, 1950.

Rule 32

Sec. 9—Modified to clarify the intent that *any type* of follower missing with draft gear in interchange, is delivering company responsibility.

Sec. (12-b)—Modified by eliminating the requirement that car owner must hold contaminated cars to give road responsible an opportunity to inspect same. Joint Inspection Certificate should be executed promptly. This change is for expediting repairs account all cars badly needed for service at the present time.

New Note 1—Added as follows: Cars carded for contaminating commodities should preferably be confined to cars suitable only for rough freight loading.

In some cases the loading line has been obliged to issue defect cards covering renewal of complete floors and lining on foreign cars loaded with contaminating commodities. This is a costly proposition and the selection of cars for such commodities must be carefully policed at all times.

New Note 2—Added to provide that where contamination can be eliminated by washing, steaming, sanding or other methods of cleaning, this should be done rather than renewing parts of car contaminated.

Interpretation No. 3—Modified to clarify the intent that external damage caused by clam shells, etc., must be to the extent specified in Rule 4 before it is considered cardable in interchange. Interior damage similarly caused should be assumed by the road on which it occurred.

Rule 57

First Paragraph and Drawing—Modified to clarify the location of the air hose clamping lugs and also to provide relocation of the coupling to the hose, so the date on the hose label will be in a better position to be identified when applied to car.

Rule 60

Sec. (f)—More cars must be exercised in removing all old air brake cleaning marks, by *scraping off* before painting over with quick-drying paint, preferably black; also in recording the old markings. A number of shops have even failed to apply new stenciling. Failure to do so results in claims for refunds under Sec. (h), as well as when retaining valve or dirt collector is not cleaned. The same care is also necessary for same reason in the recording and removal of old stencil markings for repacking of journal boxes, and application of the new stenciling.

Sec. (L), Note 6—Modified to describe method of identifying new style service portion back cover by its eight reinforcing ribs, versus only one rib on the old style cover. It also is thicker and has a reinforcing or raised bead all around its outside edge, while the old style cover has no such bead. In cases where service portion removed has new design back cover, it should be replaced in kind. The charge for COT&S has been increased 16 per cent.

Sec. (L) New Note 7—Added as follows: When AB brakes are given periodic attention, old style ball check cover of emergency portion must be replaced with new style cover (Pc. No. 95051 or C V-101). The new style cover can be identified by flange added for retaining its gasket, both covers having same piece number.

Rule 61

Sec. (a)—Modified to provide that slack adjusters, on cars so equipped, shall be inspected and repaired when necessary when car is given periodic repairs to air brakes or when car is on repair track for other work.

Sec. (c)—Modified by omitting requirement to lubricate side bearings when car is on repair track and is jacked for repairs. Lubricating center plates remains a requirement in such cases for which the charge remains the same 12 cents per car end per Item 172 of Rule 101.

Rule 66

Sec. (a), (f) and (g) and Interpretation No. 2—Modified by reducing time limits as follows for periodic repacking of journal boxes on empty or loaded cars, so as to improve lubrication performance of freight cars:

(*a*)—15 months reduced to 12 months
—14 months reduced to 11 months
(If on repair track for other work)

(*f*)—14 months reduced to 11 months
(If on repair track for other work)

(*g-1*)—15 months reduced to 12 months
14 months reduced to 11 months
(If on repair track for other work)

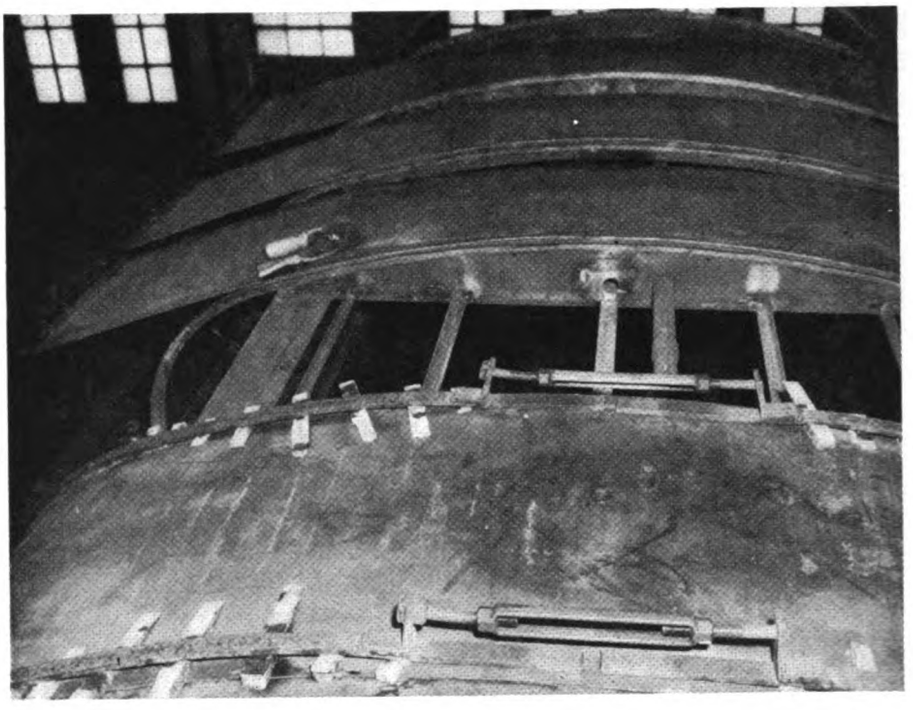
(*g-2*)—9 to 14 months reduced to 9 to 11 months—
Wheel changes, etc.

(Continued on page 68)

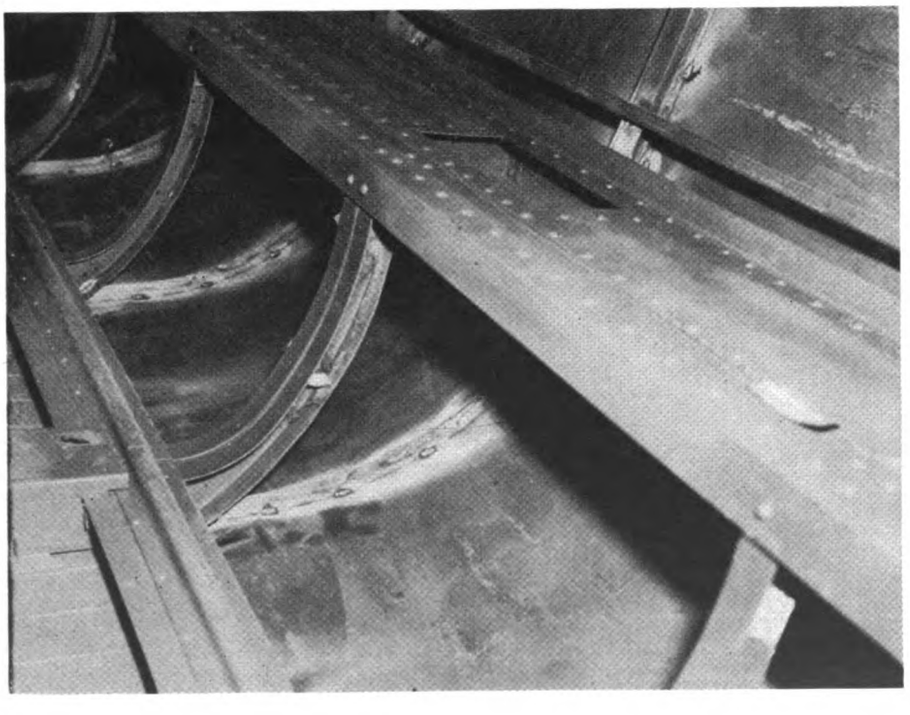
* * *



New roof sheets are positioned by turn-buckles and held for welding by wedges



Coaches Rebuilt for Modern Appearance



The roof sheets are skip-welded to the carlines on the under side, and completely cover the old roof structure

A WHEEL-to-roof face-lifting has been given at the Aurora Shops of the Burlington to a series of old-style coaches formerly used in regular passenger service but now assigned to suburban service. These reconditioned cars have auxiliary generators in one end that develop current for lighting and air-conditioning. The roofs of the old cars are hidden under new streamlined sheathing, new larger windows with aluminum frames are installed, interiors are completely modernized, and the rebuilt air-conditioned cars roll on six-wheel trucks with roller bearings.

The most elaborate alterations to the original structure of the old cars are in the roof and window frames. A new turtle-back roof is built right over the old-style double-deck roof on carlines made of angle iron 1½ in. by 1½ in. by ¼ in. These carlines are oxyacetylene flame-formed on a simple jig. The carlines are welded to the longitudinal members of the old roof and to the tops of the car sides.

Following the installation of the new carlines, roof sheets of ⅛-in. mild steel are positioned and forced into place by straps that are pulled tight by turn-buckles. Wedges are also used to force the sheets down to the carlines. The sheets are skip-welded to the carlines from underneath covering completely the old roof construction with the new roof sheets.

Once the sheets are securely held by the inside welds, butt welds are made in the sheets on the roof by means of Heliarc welding. Spacing between sheets is about ⅛ in. and the welding, using an alloy filler rod, is done at about 10 in. per min. This welding is performed by one or two operators and each seam is started in the middle with welding progressing toward the sides. Current is 110 amp. d.c. with an argon flow of 5 liters per minute. Heliarc welding permits the operator to get good penetration to the carlines and a dense, uniform deposit of weld metal with no spatter. The weld is built-up about 1/16 in. high. Only a minimum of grinding is done on the welds about 3 ft. up on each side of the roof. The top portion of the roof is painted as welded.

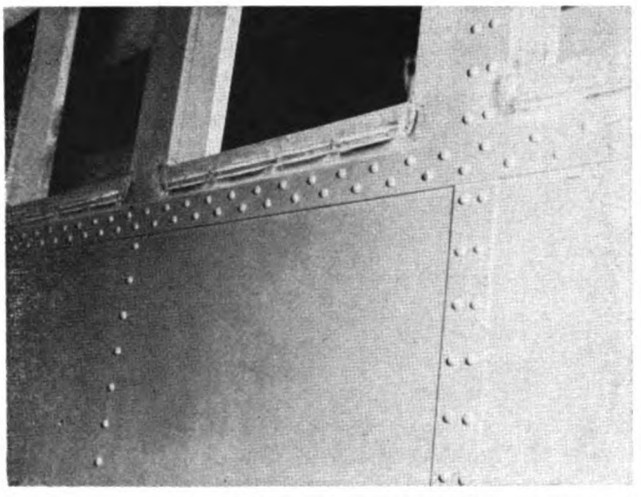
More than 360 ft. of Heliarc welding is done on each car to join the 28 roof sheets, but no expansion problems are encountered. The exhaust hatch is also welded in by the Heliarc process.

To make the new aluminum window frames fit the old openings, it was necessary to weld in steel sheet filler sections at the top and bottom. One illustration shows the angled section of ⅛-in. sheet being fitted to the bottom of the opening. This section as well as one at the top of the frame is Heliarc welded to the existing side sheets. The welded area at the bottom of a window is shown prior to light grinding. When finished, the joint is practically invisible. These horizontal welds are 34 in. long at the bottom and 28 in. at the top. The same welding data applies to these welds as to the roof welding.

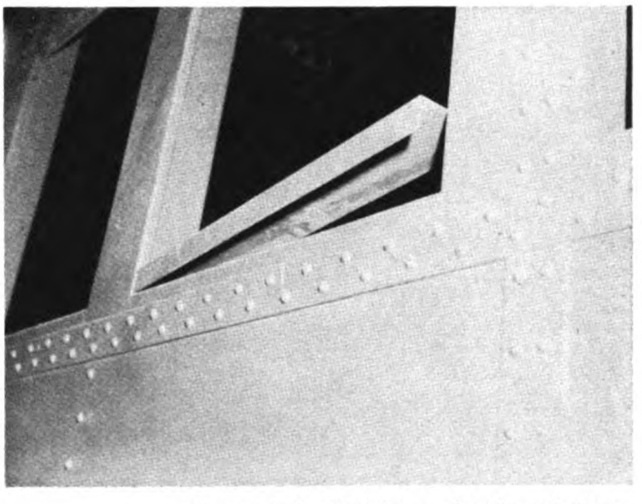
To reduce spatter problems, Heliarc welding is also used at each end where the roof sheets overhang the ends and in the welding of the four door drip moldings to the roof sheets.

Welds made with a Heliarc torch usually require no cleaning or grinding. In using this method on car areas where finish grinding is costly, the Burlington has taken a page from the automobile business. In automobile plants Heliarc welding is widely used on thin-gauge mild steel to make welds in body parts on the assembly lines.

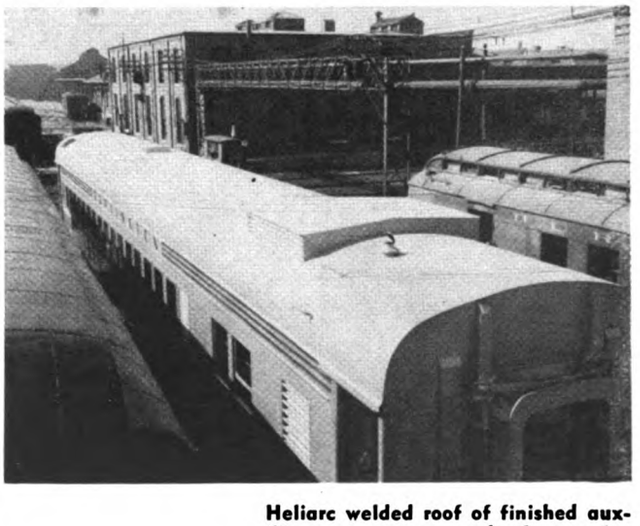
Photos are through the courtesy of Oxweld Railroad Service Division Union, Carbide & Carbon Corp.



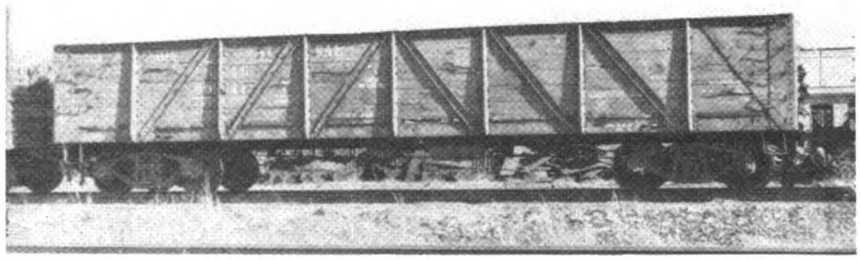
Weld between the added fill-in section and the side sheet prior to grinding. When finished, the joint is practically invisible



The angled section being placed on the lower edge of one of the window openings to be Heliarc welded to the original side sheet



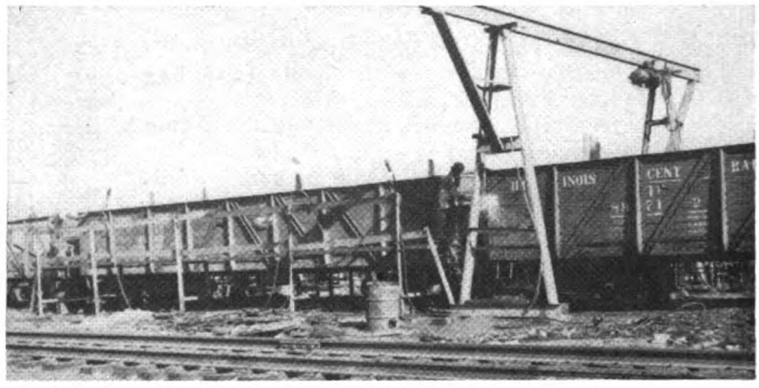
Heliarc welded roof of finished auxiliary power car ready for service

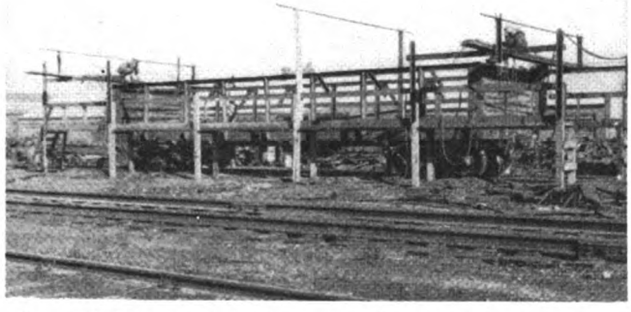


Left: A typical Illinois Central solid-bottom composite gondola car with high sides

Below: The first step in repairing the composite cars is burning out the rivets. This view is from the yard side of the dismantling track. The shop side has similar scaffolding and, in addition, a steel netting to protect personnel

Gondola Car Rebuilding Program





The scaffolding used for burning out the end rivets and top rivets after the wooden sides have been removed



The car is stipped to the underframe with the exception of the side stakes

The Centralia, Ill., shop of the Illinois Central is engaged in a program of repairing 750 solid-bottom gondola cars in which high sides are replaced with low sides. The principal lading for the low side cars will be sand, gravel, coal and agricultural limestone. Because of the nature of the lading, the low-side car will not be reduced in capacity on a weight basis, although the unloading of the cars will be considerably simplified because of the lower sides of the cars.

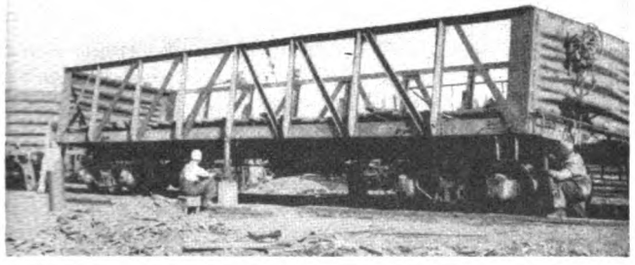
The cars will retain the present principal dimensions with the exception of the lower sides, which will reduce the inside height to 3 ft. 5¼ in. This will permit the contents to be shoveled out more easily. The new capacity is 1,350 cu. ft.

Repair Procedure

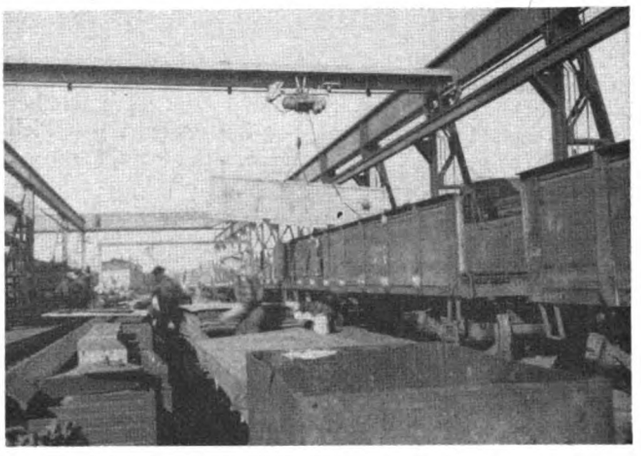
The repair procedure begins with stripping the outside of the car and burning out the rivets, removing the floors, sides and the steel ends. The side and end stakes are left in place unless renewal is necessary. The existing end and side top rails are removed to the shop for straightening. The stakes are burned off at the top to the new side height, after which the existing top rails are reapplied.

New ends were fabricated for the cars. The end top angles and the side angles are replaced on the new ends and hides. The holes in the new sides are burned and reamed after the side has been put in place and temporarily secured. Pre-drilling was not considered practicable because the cars were no longer in perfect alignment.

The trucks are completely reconditioned, but the underframes are not touched. The only air brake work required is periodic cleaning. The existing threaded train line piping was used in all cases as it was found to be



The fast and easy way to remove the existing wood flooring. The air jack in the center raises the car on one side as shown. Steel bars are placed under the floor boards, and, as the air is released from the jack, the weight of the car pushes the nails and the floor boards free. The boards can then be thrown clear of the car by hand

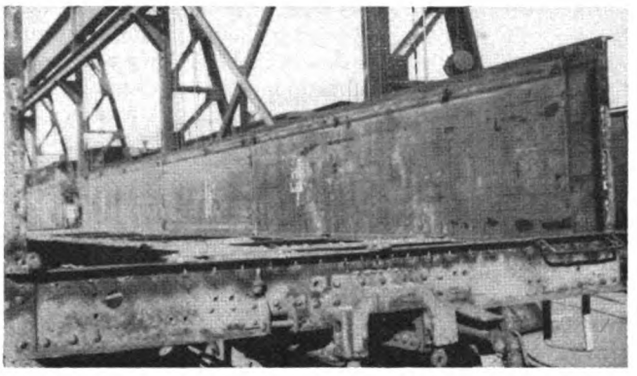


Above (right): An outdoor overhead traveling crane is used to hang the side sheets. After the sheets are temporarily secured in place, the rivet holes are burned and reamed

in good condition.

The ¼-in. sheets for the sides and ends are brought to size. Two long and one short sheet are used on each side, the short sheet being 9 ft. 10 in. long and the long sheet 14 ft. 6⅛ in. long. Each end is reinforced by two old side stakes or 5 in. by 3½ in by ½ in. angles from retired cars. These reinforcements run horizontally across the inside of the end. When stakes are sold they are riveted in place; where angles are used the flanges are turned toward the end sheet and welded threto, forming a triangular box section. The sides are reinforced by three inside brace gussets on each side. These are riveted to the sides and to the cross-bearers.

The floor is nailed to four oak nailing stringers with a cross section 4 in. by 6 in. All underframes are coated with an asphalt base car cement.



Interior of the car with the side sheet temporarily bolted in place for burning and reaming the rivet holes





An offset is put in the side sheets at the top and the bottom edges by the roller shown above

Left: Interior of a low-side car showing the end and side reinforcements. Below: The car ready for service



Dust Guard Plugs

In a circular letter dated January 29, the A.A.R. Mechanical Division again called attention to the large number of plugs missing from journal-box dust-guard slots which results in rain, snow, and foreign matter contaminating the packing in the box.

The importance of maintaining satisfactory dust guard conditions and replacing plugs when found missing is generally recognized but sometimes overlooked. In this connection, the circular makes the following comments about conditions which are general over the country:

"A plain wooden dust-guard plug does not adequately seal against water unless it is individually fitted; and even when made close fitting, it has insufficient holding power, due to continual swelling and shrinking, to remain in place for any length of time. There are on the market metal clips for holding wooden dust guards in position which improve the holding properties; and wooden guards may be sealed with a plastic material which makes them more efficient.

"When metal covers are used, it is important that they be properly applied by forming them to fit the journal box, after which the ends should be bent down and covers tightened in place. When metal covers are found loose in service they should be tightened by suitable means.

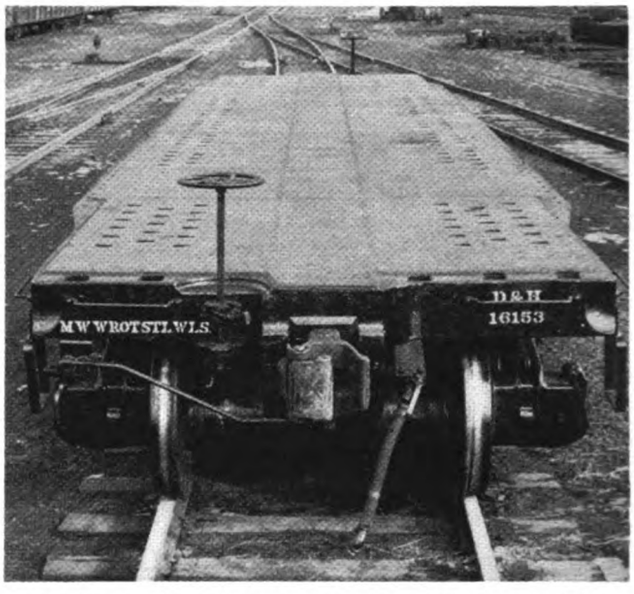
"The practice of sealing dust guard plugs with plastic material is proving successful in service, and this method of application is recommended. The three accompanying illustrations show sealed dust guard plugs, cut away at the center for better viewing a wood plug, metal plug, and a fibrous, or felt-type plug.

"When wheels are changed it is essential that dust guard plugs be properly re-applied. Dust guard plugs can also be given attention when cars are on repair tracks, or at the time of periodic re-packing, and this should be arranged for, as it will be helpful in reducing hot boxes."

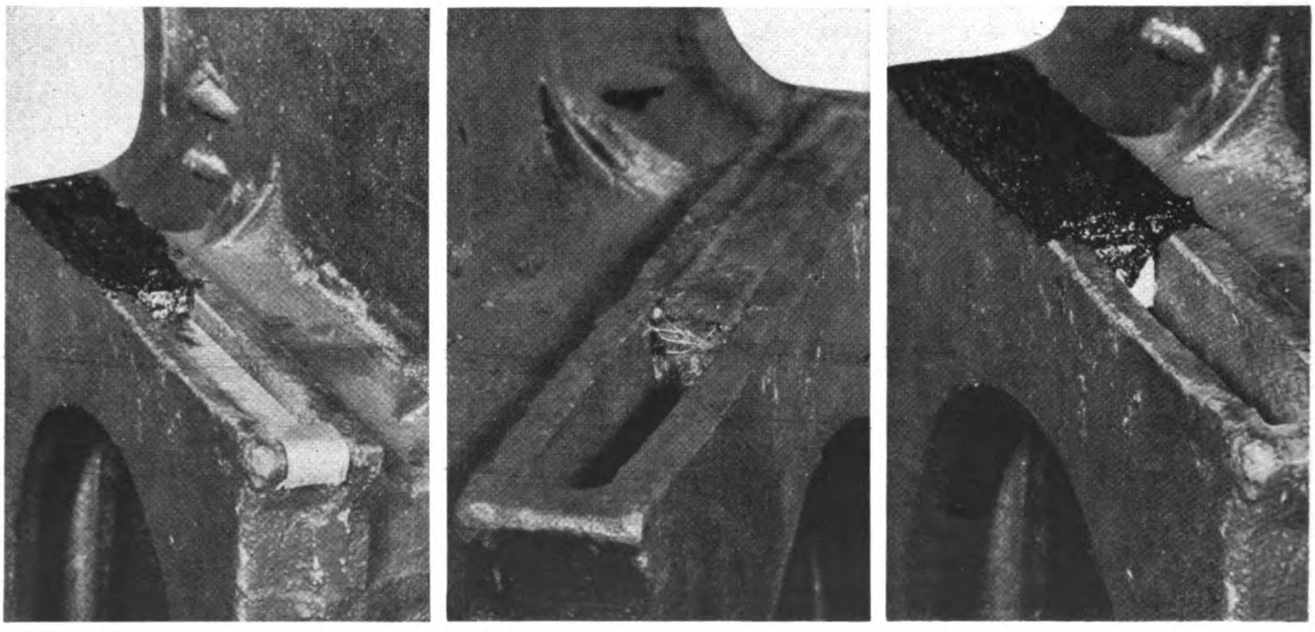
The circular letter closes with a request that appropriate instructions be issued to repair forces on individual roads to make sure that this important subject is followed up.

A Flat Car with 500,000 Lb. Capacity

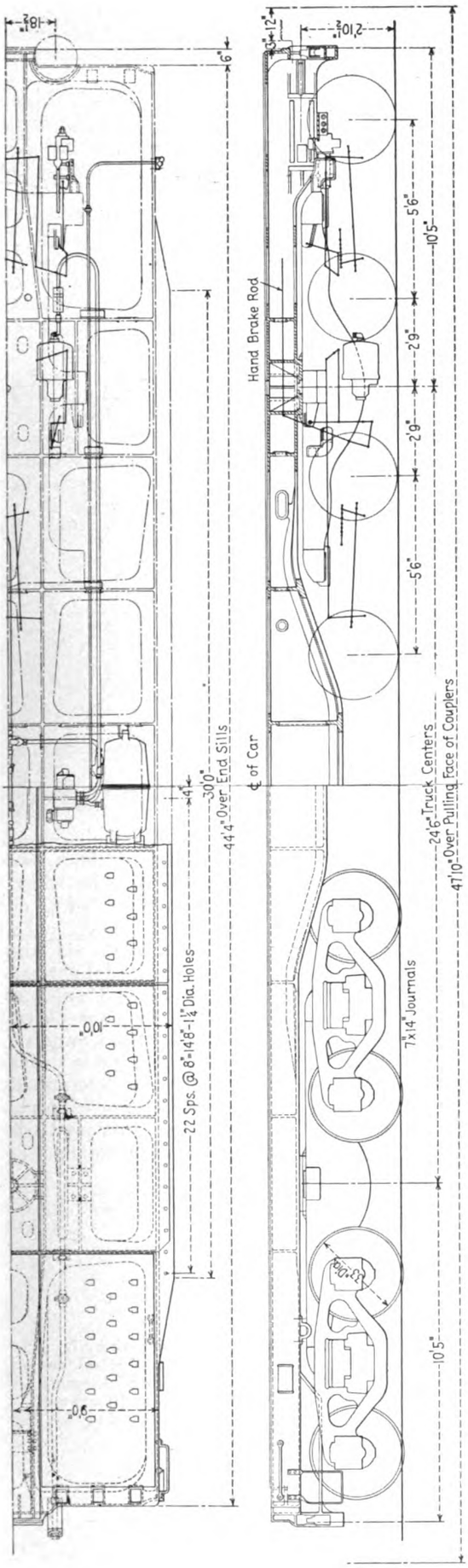
A flat car, No. 16135, designed to handle single loads weighing upwards of 400,000 lb., has recently been assembled at the shops of the Delaware & Hudson at Oneonta, N. Y. The body comprises a one-piece cast-steel frame of low-carbon nickel-steel with a ½-in. Cor-Ten steel floor secured to the top of the casting by a continuous weld. Through the top floor plate slots and holes are provided for securing the loads. Slots are designed for the use of T-head bolts. The holes are 1¼ in. in diameter and are arranged in a row along each side of the floor.



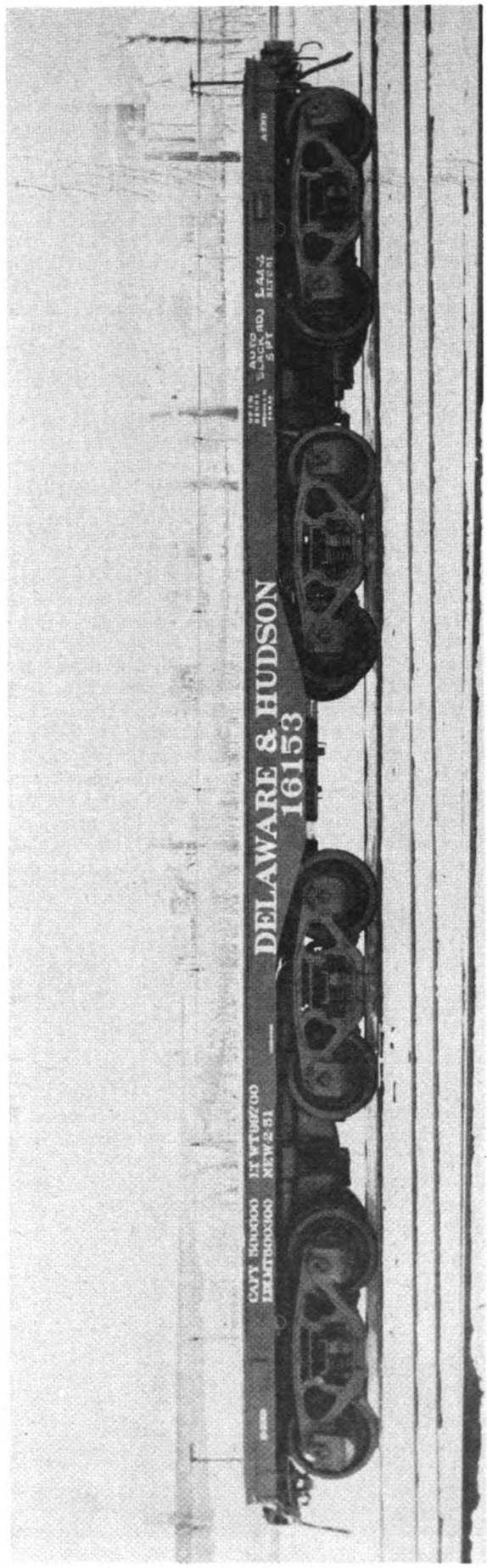
In the top of the flat car are T-slots and tie-down bolt holes



Left: Application of steel strip dust-guard plug sealed with plastic compound. Center: Felt dust-guard plug sealed with plastic compound; Right: Application of wood dust-guard plug sealed with plastic compound



Cast-steel flat car for single loads up to 250 tons



The length of the frame over striking plates is 45 ft. 4 in. The width of the car for 30 ft. at the center is 10 ft. and for 4 ft. 2 in. at each end, 9 ft., with 3-ft. taper connections between the two widths. The height from rail to top of floor is 4 ft. ½ in. The underframe with floor plates intact was supplied by the General Steel Castings Corporation.

The trucks comprise two eight-wheel assemblies. The two trucks under each end are connected with span bolsters. The wheel base of the trucks is 5 ft. 6 in. and the span bolsters between truck centers are 11 ft. long. The four axles at each end are thus equally spaced. The span-bolster center plates are spaced 24 ft. 6 in. The side frames, truck bolsters, and span bolsters are of cast steel. The multiple-wear wrought-steel wheels are 33in. diameter and the journals 7 in. by 14 in. Each nest of bolster spring has five double coils with 1⅝-in. travel and two Simplex snubbers.

There are two 12-in. AB air-brake equipments. The reservoirs and brake valves are mounted under the middle of the car floor and each equipment operates the brakes on the trucks at one end of the car. Westinghouse automatic slack adjusters and Equipco high-powered A. A. R. certified brakes with drop shafts are installed at each end.

The draft gears are Miner A=22XL. The American Steel Foundries couplers have 6¼-in. by 8-in. swivel shanks. Other equipment on the car includes Imperial rotary release rigging, Magnus bearings, National Malleable journal-box lids, Jenkins leather fiber dust guards with Cenco dust-guard retainers, Davis No. 18 brake beams, Schaefer loop-type brake hangers, Illinois Railway Equipment brake-hanger retainers and keys, and Chicago Railway Equipment single-type brake-beam safety guards.

The car, which has a light weight of 99,700 lb. and a load limit of 500,300 lb., is almost identical to one built simultaneously for the New York Central by Merchants Despatch at East Rochester, N. Y. The principal difference is the hand-brake equipment. The N. Y. C. car has a hand brake at one end only; is 1,000 lb. lighter and, therefore, has a load limit 1,000 lb. higher.

Experimental Sand Handling Car

The Illinois Central has built an experimental flat car on which is mounted portable sand conveying equipment for handling locomotive sand at points on the system where clam shells are not employed. The car has the necessary brackets for securing, and a hoist for loading and unloading the two-piece sand conveying arrangement, which was manufactured by the Centralia Engineering and Machine Corporation.

The car is moved to various terminals as it is needed. The tie-down arrangement on the car which holds the conveyor equipment in place is permanently mounted for transit, as is the hand winch for unloading the two sections.

When this car arrives at the point where sand is to be unloaded, the two pieces of the conveyor are set on the ground with the hand winch. The rear section in the illustration is placed under the opening of the car of sand to be unloaded. The long section is depressed on its loading end to fit under a trough on the first section, raising the unloaded sand for delivery to the sand bin.

Both sections are mounted on rubber-tired automobile wheels for easy movement. Both are also balanced about the wheels to facilitate easy handling by hand after unloading by the winch. These two features have resulted in overall easy handling from the flat car to the final sand delivery position, and vice versa, for the 1½-ton long section and for the small section which weighs just under a ton.

1951 Interchange Rules

(Continued from page 61)

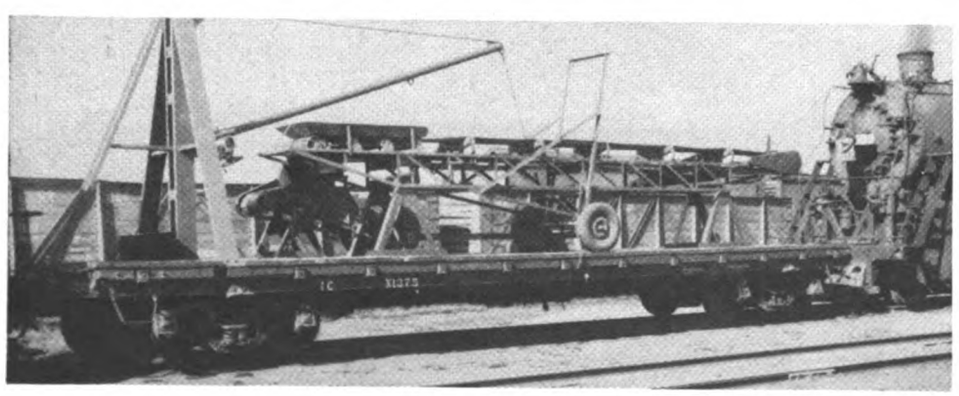
(*g-3*)—4 to 9 months reduced to 4 to 9 months—Wheel changes, etc.

Interp. No. 2—14 months reduced to 11 months—Bad stenciling

In addition to the reduction in time limits, A.A.R. charges for this work have been increased about 28 per cent effective January 1, 1951. Care *must* be taken in thoroughly cleaning the journal boxes inside "of all dirt, sand, scale, grit, water, or other foreign matter, and the front of the box as well as the inside of the lid wiped clean" as required by the A.A.R. Standard Lubrication Manual. Furthermore, under new Rule 3-j-3 empty cars having repacking date more than 15 months old may be effective January 1, 1951, rejected from owners.

Sec. (*c*)—Modified to provide that if car is stenciled with solid white square per Note under Interpretation No. 4 indicating it is equipped with approved packing retainer devices, such stenciling must be renewed when journal boxes are given periodic repack attention.

(To be continued in the May issue)



Experimental car built by the Illinois Central for handling sand at points where clam shells are not employed

Traction Motor Overhaul

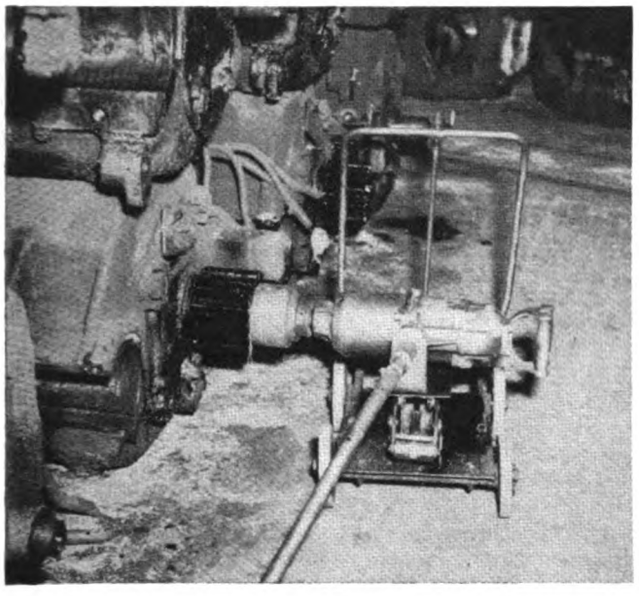


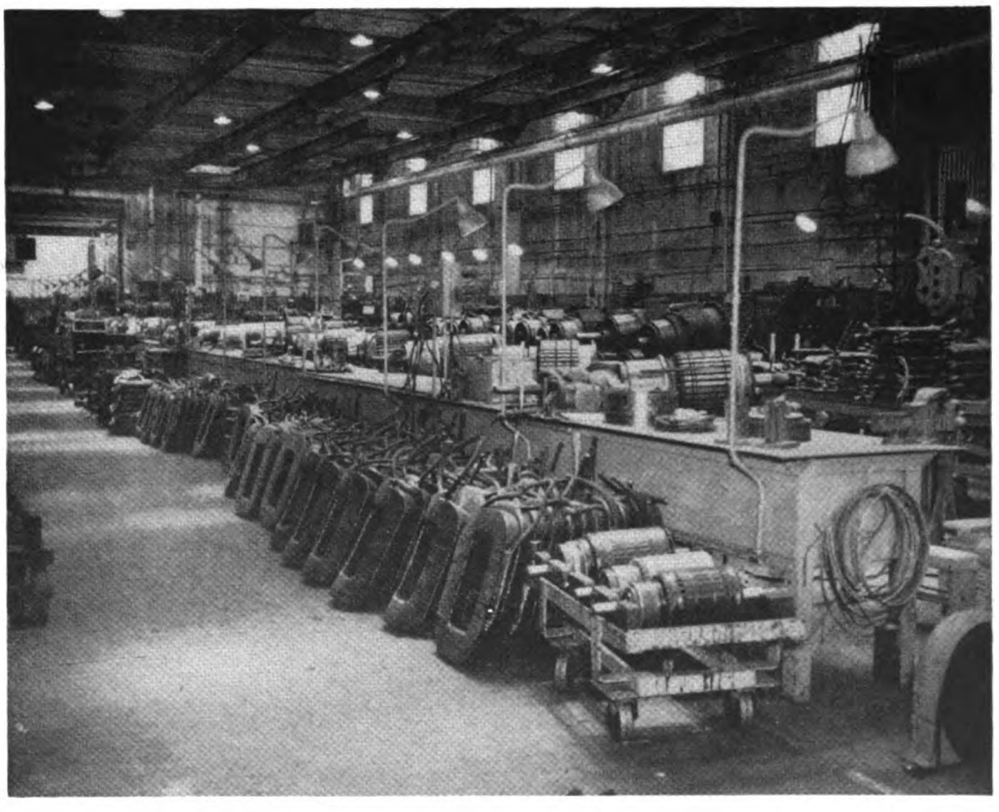
Fig. 1 (above)—An impact wrench mounted on a dolly is used for releasing the pinion nut

Methods developed in shops of New York Subways afford some hints to diesel traction motors maintainers

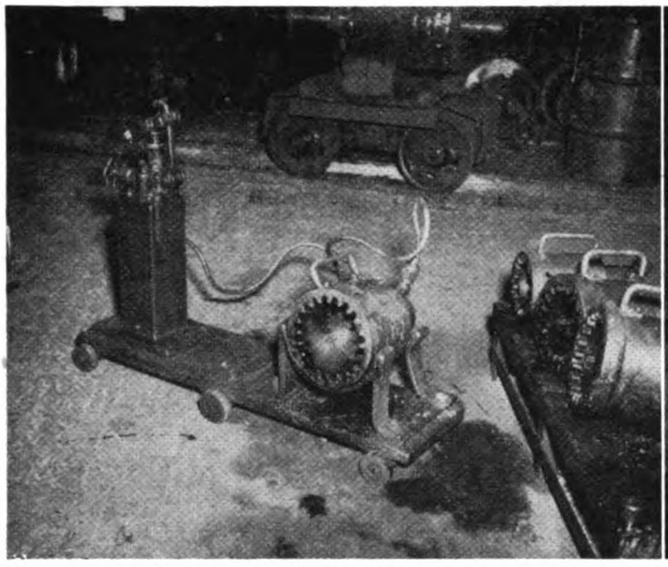
*By Michael Axler**

WHEN TRACTION motors, used on New York City subway cars, require periodic overhaul, the cars are brought into the Board of Transportation car shops. The car body is lifted with a 45-ton crane, the trucks rolled out, and the car bodies set down on rigid supports. The trucks are picked up with a 25-ton crane and transported

* New York City Board of Transportaion, I.R.T. Division.



General view of motor shop



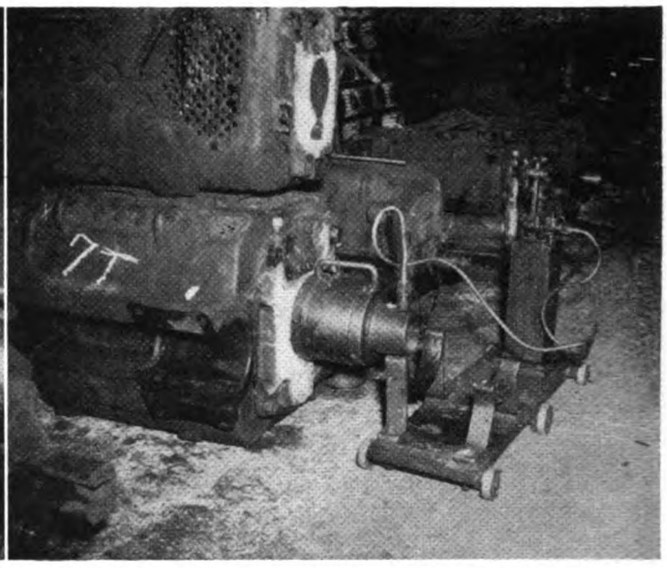


Fig. 2 (left)—Hydraulic puller for removing pinions.—Fig. 3 (right)—The puller as applied to a motor pinion

to the truck shop. The motors are lifted out of the trucks with an electric hoist and placed on a dolly. A monorail crane is used to lift the motor from the dolly and transfer it to the motor shop. The monorail crane runs on the lower flanges of a 15-in. I-beam, suspended from the shop ceiling.

The first overhaul operation is the removal of the pinion nut. This is done with a No. 375 Chicago Pneumatic impact wrench mounted on a dolly (Fig. 1). The wrench is mounted on the dolly on a pantograph jack which permits adjustment to the varying heights of the different motor pinions. The jack may also be rotated through 360 deg. so that it is not necessary to line the dolly with the motor shaft.

When the wrench socket is applied to the nut, the wrench trigger is pressed and the nut is released instantly. It is unnecessary to block the pinion, the inertia of the armature providing sufficient reaction.

Before the impact wrench was adopted, it was necessary to block the pinion with a special holder and remove the pinion nut with a box wrench, having an 8-ft. handle.

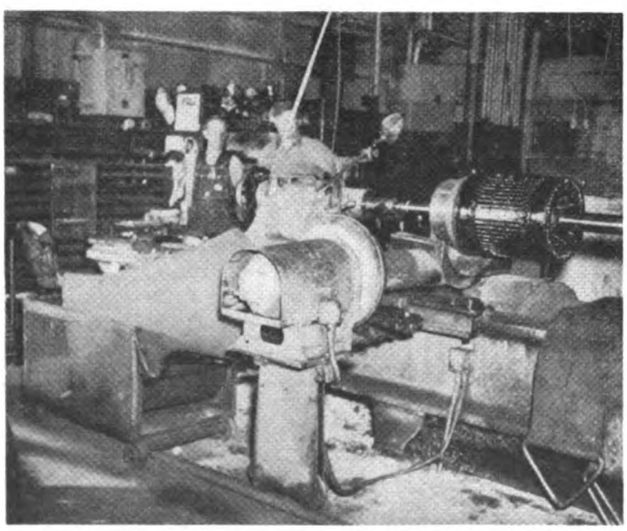


Fig. 6—Lathe used for turning commutator and shaft

One man would hold the wrench on the nut, and another would stand on the end of the wrench handle.

The pinion is keyed on a tapered shaft. When it is applied, it is heated to a temperature of 213 deg. F. to 238 deg. F. in hot oil and then is driven onto the shaft taper with a 20-lb. hammer to insure a good shrink fit when it cools to atmospheric temperature.

The former method of removal required the use of wedges on each side between the back of the pinion and the bearing housing. The wedges were driven in while the heat from a gas ring of 1-in. pipe was applied to the pinion for a 20- to 40-minute period.

The present method of removal employs the puller shown in Figs. 2 and 3. The toothed section of the open end of the puller matches the pinion teeth so that it may be slid over the pinion. After it is slid beyond the pinion, it is turned so that the teeth on the puller are back of, and in line with, the pinion teeth.

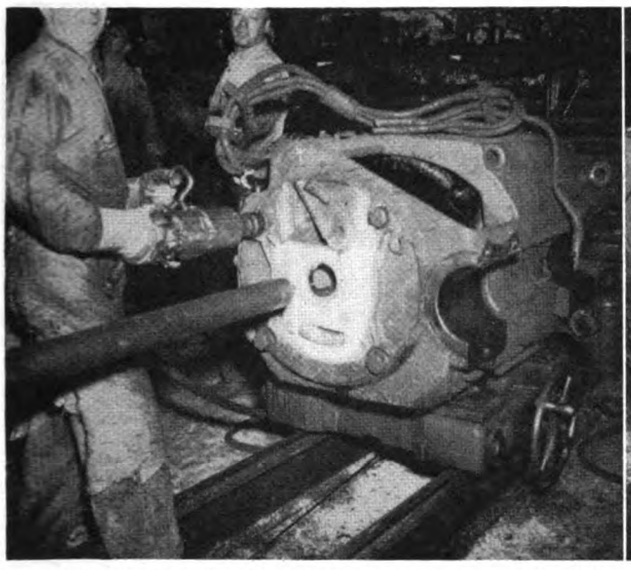
The opposite end of the puller is equipped with a hydraulic jack which engages with the end of the armature shaft. When pressure is applied by the hand pump on the puller dolly, pressure is applied respectively to the shaft and the back of the pinion teeth, and the pinion comes off. As may be seen in Fig. 2, the pinion drops into a cradle and does not fall on the floor. The operation requires from two to three minutes.

After the pinion is removed, the motor is transferred by means of a monorail crane to the special machine shown in Figs. 4 and 5. At one end of the machine is a long fixed center for the commutator end of the armature, and at the other end of the machine is an adjustable center for the pinion end of the motor. The carriage which supports the motor frame is adjustable for height and lateral and may be moved longitudinally along the track on the base of the machine.

The centers have diameters which are smaller than the armature shaft and the fixed center is long enough to extend through the motor frame or housing.

To remove an armature from a frame, the frame is placed on the carriage of the machine and its height adjusted to match the machine centers with those of the armature shaft. The centers are then placed in the armature and tightened.

The housing bolts are removed with a No. 365 Chicago



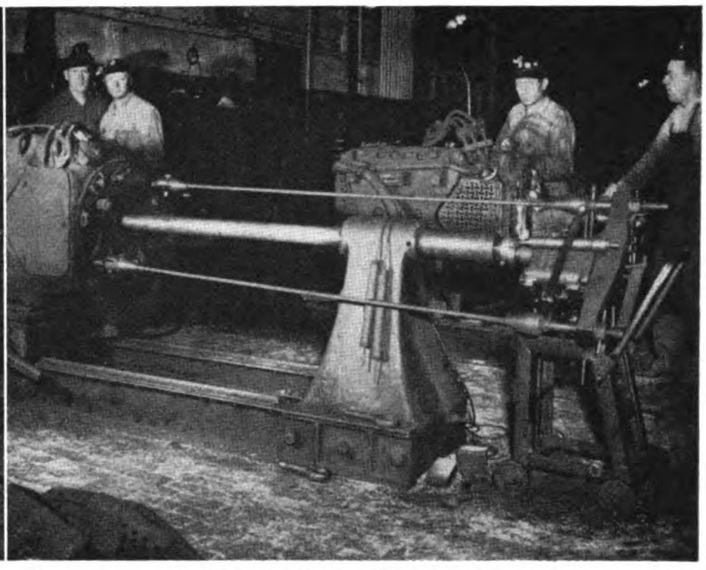


Fig. 4 (left)—End housing cap screws are removed with an impact wrench. Fig. 5 (right)—Machine for removing armature from motor frame. Hydraulic jack at right is being used to remove end housing by applying pressure on center and pulling housing with two wire cables.

Pneumatic impact wrench as shown in Fig. 4, and eye bolts are screwed into two holes on opposite sides of the end frame. Two lengths of steel cable are attached to these eye bolts screwed into two holes on opposite sides of the end frame. Two lengths of steel cable are attached to these eye bolts by means of a clevis connector and the opposite ends of the cables are attached to a hydraulic jack which bears against the end of the long center. The cable attachment is a threaded rod, and the nuts on these rods are first tightened to take the slack out of the cables as shown in Fig. 5. Then, when pressure is applied to the long center by means of the jack, the cables release the end housing of the motors. Two of the end-frame cap screws are not removed completely, but are backed out leaving enough threads to hold the end housing after it is released. This makes it possible to handle the motor frame and end housing as a unit after the armature is removed.

The pinion end housing is removed in a similar manner. The cables are attached to the motor frame by eye bolts which pass through the cap screw holes in the commutator end housing and screw into the holes in the motor frame. The cap screws which hold the pinion-end housing are removed with the impact wrench, and when pressure is applied by the jack through the long center and the motor shaft to the pinion-end housing, the motor frame moves with the carriage and the housing comes off.

The carriage of the machine is then moved along over the long fixed center, exposing the armature. The monorail hoist is used to pick up the armature with a canvas belt sling.

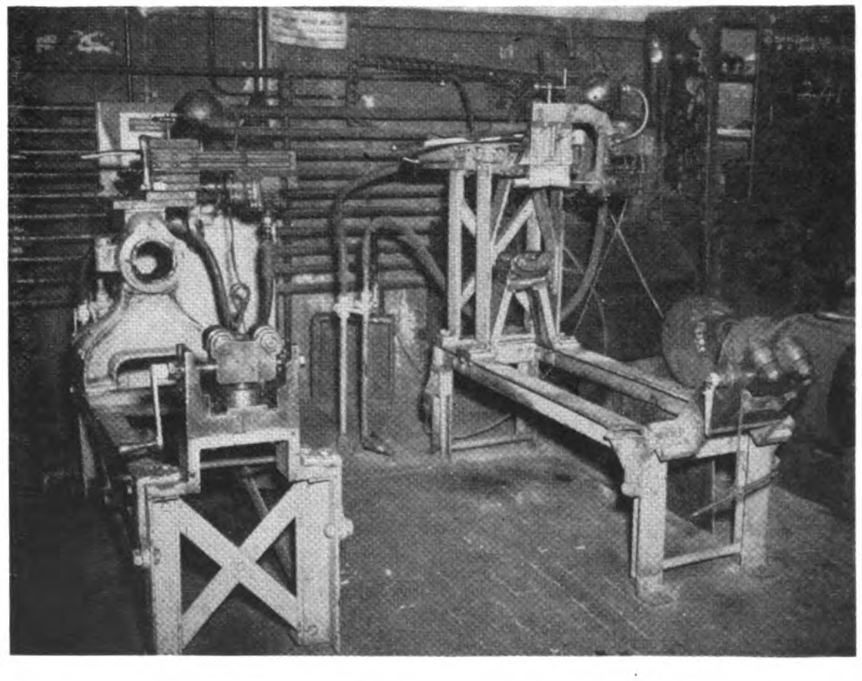


Fig. 7—Undercutters, rear heads drop to place armatures and are adjustable vertically and laterally for lining commutator slots parallel with the armature shaft

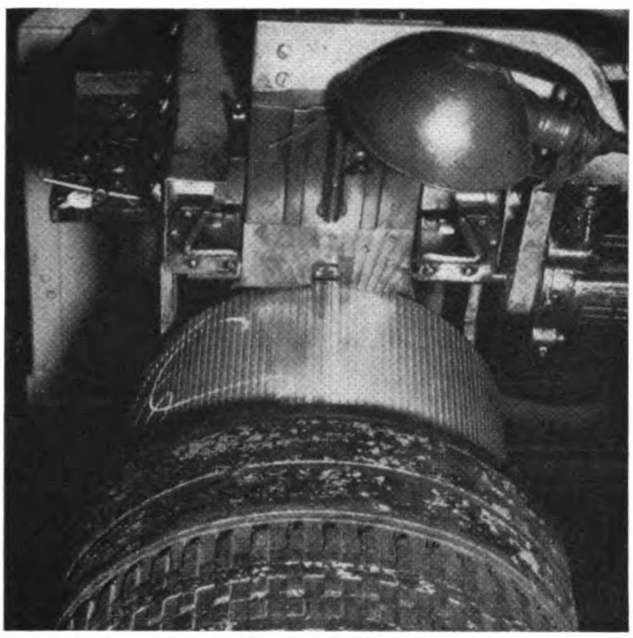


Fig. 8—Close-up of a commutator with the undercutter in position for starting a cut.

The armature is transferred to a cleaning cabinet where it is blown out with compressed air at 100 lb. pressure. The armature is inspected and tested and if it is good, the commutator is turned and polished if its condition requires such refinishing. The mica dust and copper shavings are exhausted from the lathe by a special attachment shown in Fig. 6. Commutator mica is undercut by means of two machines shown in Fig. 7. It will be noted that the rear carriages may be dropped down to facilitate placing of the armature as is shown on the machine at the right. Testing and banding are done on the machine shown in Fig. 8.

When required, armature shafts are turned and polished, also on the lathe shown in Fig. 6. All the motor bearings are sleeve bearings, and a turned motor shaft, of course, requires a bearing to fit. Bearings are bored and fitted by means of the equipment shown in Fig. 9. The bearing is removed from the motor end housing and a new bearing applied by the press at the left. The end housing is then bolted into the circular plate in the positioner in the foreground. The plate is a jig which fits into the vertical boring mill at the rear. The bearing is bored to fit the shaft with which it is to be used.

Overhauled armatures are dipped in air-drying varnish and baked overnight at 250 to 275 deg. F. When motors are assembled, the proceeding described is reversed. After assembly is complete, the motor is tested, and given a running test after which it is ready for service.

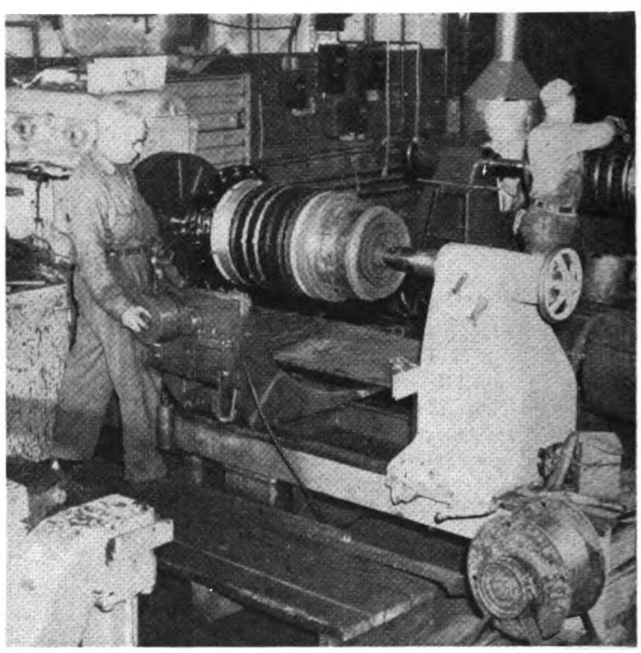


Fig. 9 (above)—Banding machine

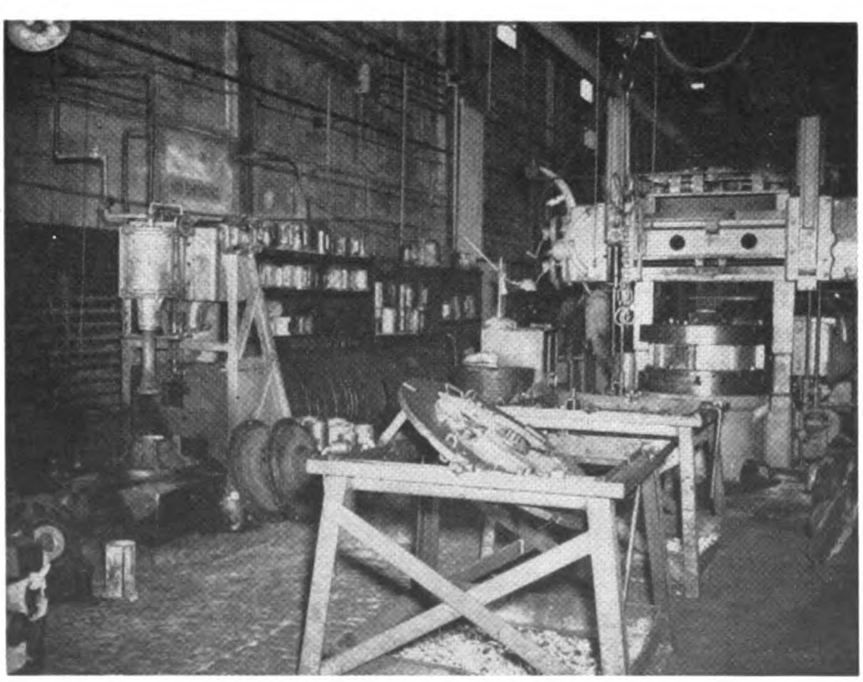


Fig. 10 (left)—At the left is the bearing press. In front are two positioners holding jigs which hold end frames when bearings are bored in the vertical boring mill at the back

Parallel Operation of Undercar Power Plants

Control system provides for automatic paralleling of generators without synchronizing equipment and shows a reliability much better than that for cars which are not paralleled

*By G. W. Weber**

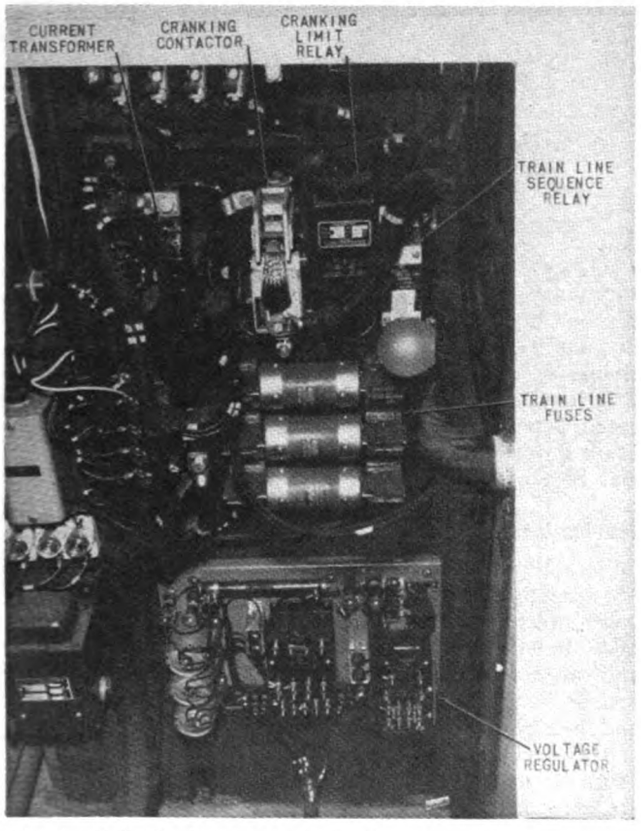


Fig. 1—Individual car control panel

FOURTEEN of the new diesel-driven undercar power plants, developed by the General Electric Company for passenger car power supply, have been operating successfully on the "More Power to America Special" since this train started its tour of the United States in the spring of 1950. This train, frequently called a "showcase on wheels," consists of a two-unit 4,500-hp. Alco-G.E. diesel-electric passenger locomotive, ten display cars, a baggage-dormitory car and three Pullmans.

Each display car is equipped with one undercar power plant, and four additional plants are mounted in the baggage-dormitory car. The fourteen 30-kw. alternators are automatically paralleled on a trainline bus when the trainline couplers are made up, thus constituting the first completely automatic parallel train system to be operated in regular service. They provide over 400 kw. for lighting, air conditioning, space heating, and the heavy electrical exhibit load.

Power plant installations on the display cars are identical to that proposed for railway passenger cars. Present plans call for putting these ten cars into regular passenger service when the exhibit tour is completed.

An excellent demonstration of the operation of the system has been arranged in the meters and instruments display car. Grouped on an exhibit panel are: wattmeters, voltmeters, ammeters, synchroscopes, temperature gages, and pressure gages which have been connected to the plant beneath this car. The effects of starting and stopping the plant, paralleling it with the train line, starting the air-conditioning compressor, etc., can be observed by watching the meters on this panel.

The history of this development and the many design problems involved have already been reviewed.*

This article is devoted to a description of the control system. The power plant consists of a six-cylinder, vertical diesel engine direct-connected to a three-phase, 230-volt alternator and its shaft-mounted amplidyne exciter. The plant is pivoted in its housing so that it can be swung out from under the car, exposing all sides for easy maintenance. The engine is rated 48 hp. at 1,800 r.p.m., and the alternator is rated 33.8 kva. at 90 per cent power factor. The alternator is designed so that sets may be paralleled at random, regardless of phase difference or small frequency differences. A 200-amp. train line bus is established through the train by special electric couplers. Train line control circuits provide for the automatic paralleling of all plants on the bus when the couplers are made up between cars.

The control equipment for this system may be divided into three groups: Engine control, excitation equipment, and train line equipment for parallel operation. The engine control consists of two small control stations, a relay and contactor for automatic cranking, a fuel limit solenoid, and various thermostats and switches for engine protection, a line contactor, static battery charger, and the engine governor. The excitation equipment cnnsists of a static voltage regulator, a current transformer, and the amplidyne exciter. Train line control equipment con-

* Control Engineering Division, General Electric Company, Erie, Pa.

* "Undercar Engine-Driven Power Plants for Railroad Passenger Cars" by D. R. MacLeod, A.S.M.E. Paper No. 49-F7. Reprinted in Railway Mechanical Engineer, October 1949, pages 578-583.

sists of the train line couplers, a line contactor, and a time delay relay.

Engine Control

The complete control of each car power, load and bus system is placed in one simple three-position switch. In the *OFF* position of this switch the plant is stopped, the system is isolated from the train line bus, and all control load is disconnected from the battery. Train line control circuits are completed; however, so that cars on either side may be trainlined together. In the *TL* (train line) position, the load bus is connected to the train line bus, but the plant is not operating. It is then possible for the car to draw power from the train line without operating its own engine. The third position, *ENG-TL*, is the same as *TL*, except that the engine is running, and the plant is automatically connected to the train line.

To start the engine, the selector switch is turned to the *ENG-TL* position. This closes the cranking contactor and the starter cranks the engine until it fires, or until the cranking time limit relay picks up after 30 seconds. If the engine fails to start, this relay prevents a retrial until the selector switch is turned to *TL* and then back to *ENG-TL*. The relay is also used to delay the closing of the generator line contactor for 30 seconds after the start of cranking if the engine fires before that time has elapsed. This gives the engine time to warm up slightly before having to carry load. The starting of the plant is entirely automatic, leaving nothing to the discretion of the operator, other than the selection of one of the three positions of the control switch.

For control of the plant during maintenance and inspection periods, a three-position switch is placed in the engine box. This is designated as a safety switch, and is marked *HAND-OFF-AUTO*. Except in the *AUTO* position, it takes precedence over the main control station and permits the plant to be operated from the engine box without fear of interruption from the inside control. This is particularly useful in conjunction with the swing-out feature—enabling the power plant to be operated for maintenance purposes when it is out from under the car.

A combined pressure-temperature switch in the lubricating oil system serves a triple purpose. As oil pressure builds up when the engine starts, this switch opens the cranking contactor. It also operates on either low oil pressure or high engine temperature to de-energize the fuel solenoid and shut down the engine.

Another thermostat with separate controls prevents load from being applied to the engine in cold weather until the jacket water has reached 70 deg. F.

The engine is cooled by a separate radiator unit with a motor-driven blower that requires 1.1 hp. This blower is cycled by a thermostat to hold engine cooling water temperature between 163 and 175 deg. F. at the radiator outlet.

A 150-amp.-hr., 32-volt, lead-acid battery is used on the cars of the exhibit train for engine cranking. A rectifier battery charger, rated 15 amp. continuous, supplies control power and maintains the battery charge. This charger has a drooping voltage-load characteristic so chosen as to limit the current when charging a discharged battery, and to avoid gassing when the battery is floating on the line in a fully charged condition. It is connected directly to the car load bus, so that whenever there is power on the car, the battery is on charge.

The parallel operation of alternators gives the engine governor particular importance in this system, since the

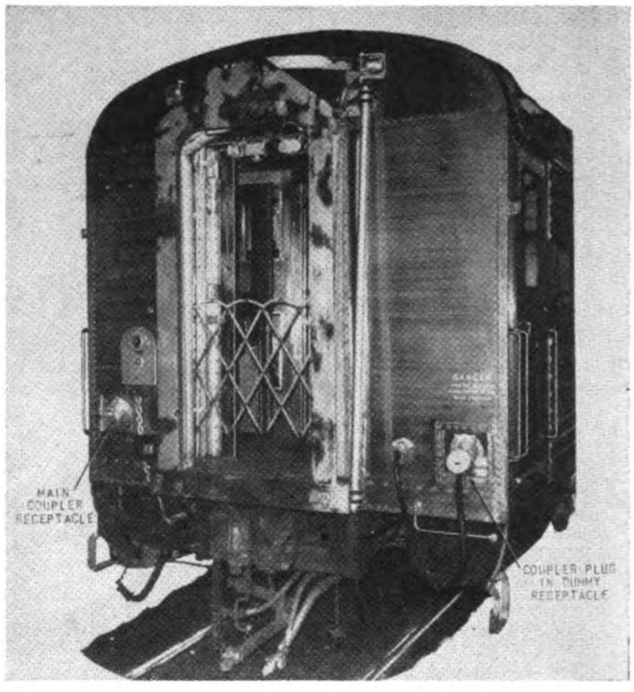


Fig. 2—End of car showing train line connectors

speed-load characteristics of the engine determine the division of load between plants. In order to secure good division of load between units, all engine governors should be set as close together as possible at no load. Experience indicates that a 5 to 6 per cent droop in speed between no load and full load is desirable. The usual governor damping is adequate to prevent hunting and help maintain system stability.

Excitation System

Both the automatic paralleling of alternators without pre-synchronization, and the starting of heavy loads impose severe requirements on the power plants. To minimize the effect of such disturbances on fluorescent lights and other car equipment, an ultra-high speed excitation system is used. This consists of an amplidyne exciter and a high-speed static regulator.

The exciter is fitted with a series field, which will cause its output voltage to go to maximum when there are zero ampere turns on the control fields. When the line-to-line terminal voltage drops to a very low value (as in paralleling two alternators which are 180 deg. out of phase), the exciter voltage goes to the celing value. This is the primary requirement for rapid system recovery.

A boost control field is also provided to preclude the possibility of reversing the exciter polarity when paralleling sets that are 180 deg. out of phase.

The regulating or buck field of the emplidyne is energized from a nonlinear saturable reactor circuit, designed to give a steeply rising current in the neighborhood of 230 volts. This signal is amplified by a magnetic amplifier to a level such that it is capable of driving the exciter to full ceiling voltage in the reverse direction when the line voltage exceeds 230. The combined time constants of the control circuit provide such high-speed excitation voltage changes that field forcing is obtained within two cycles.

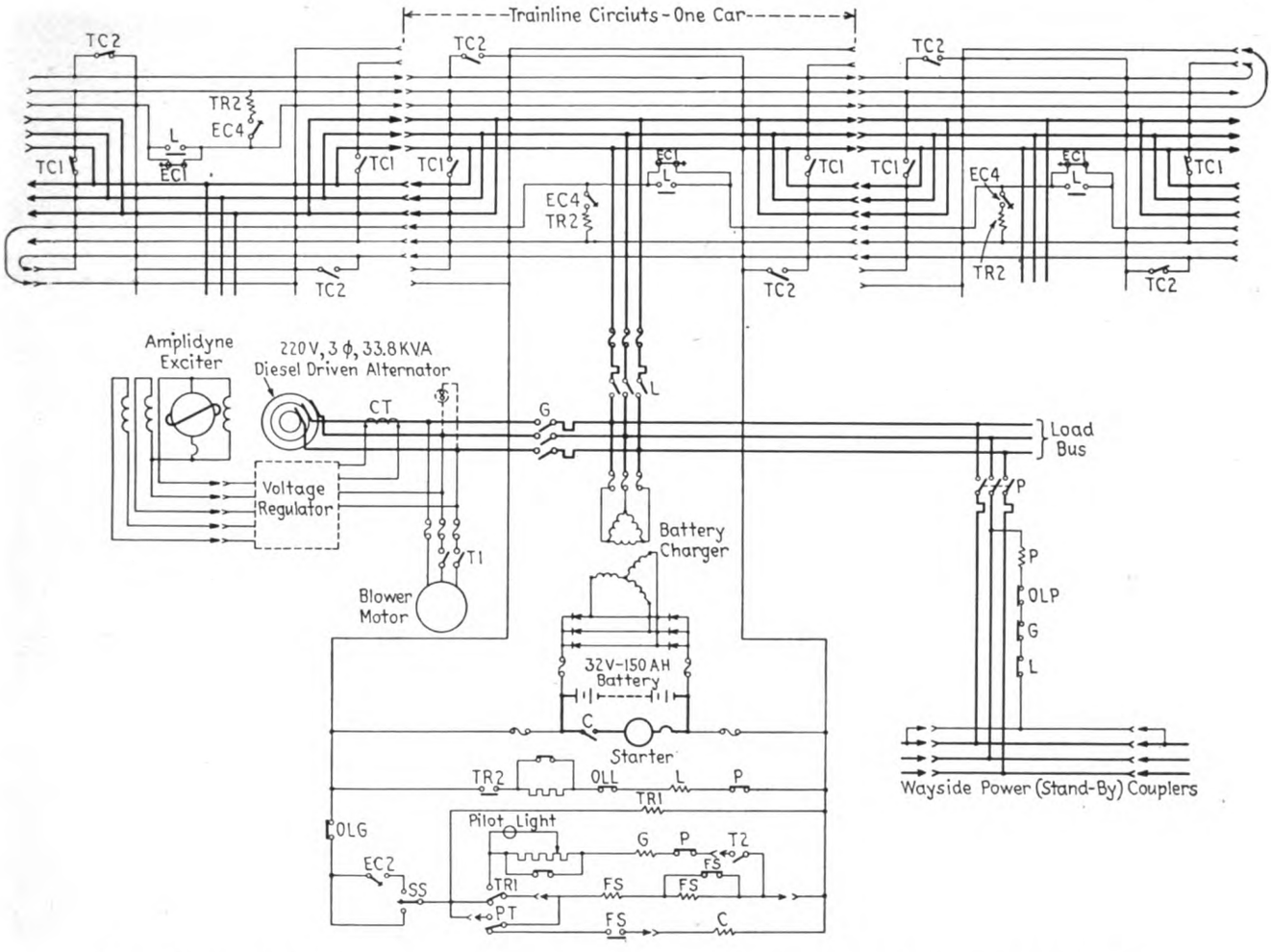
The saturable reactor used as a voltage reference is

also sensitive to frequency. Therefore, a compensating tuned circuit is used to insure constant voltage over a frequency range of 58 to 62 cycles. The result is that with unit power factor load the voltage variation is about ± one volt.

Only the saturable reactor, the input transformer, and the control resistors play a significant part in setting the regulated voltage. All of these elements are static and have extremely stable characteristics, so it is expected that the voltage of any particular power plant and regulator will not drift appreciably during many years of operation. Furthermore, experience indicates that any combination of power plant and regulator will give a voltage not more than three volts away from the 230-volt nominal, without adjustment. The voltage can be adjusted over a wide range by means of taps on the input transformer and the saturable reactor.

A reactive current bias is provided to equalize the voltages of plants operating in parallel without excessive circulating current flow. A current transformer is connected in one line to provide a voltage signal which is in quadrature with the regulator voltage signals taken from the other two lines. This cross-compensating causes the regulator to act as if the voltage were high or low, as the case may be, and it adjusts the excitation accordingly. The resultant lowering or raising of the generated voltage is compensated by the desired flow of reactive current through the generator impedances. In addition, the cross compensation causes some regulation. For instance, with 0.9 power factor lagging rated load, the voltage droop is about 4 per cent. The division of reactive load between alternators operating in parallel is determined by the generated voltages and the impedances between them. Therefore, their no-load voltages should be set as close together as possible.

The radial system of power distribution is employed in the power train line. Once the cars are coupled together, there is a continuous bus from end to end of the



G. Generator contactor
L. Trainline contactor
P. Wayside power contactor
C. Cranking contactor
TR1. Cranking time limit relay
TR2. Trainline time delay relay
T1. Radiator blower thermostat
T2. Cold engine thermostat
PT. Low oil pressure-high water temperature switch
FS. Fuel solenoid
CT. Current transformer
SS. Safety control station
EC. Engine control station
TC. Trainline coupler interlock
OLG. Generator overload relay
OLL. Trainline overload relay

Fig. 3—Schematic diagram of undercar power plant installation showing trainline circuits of three cars

train. Each car's generator, load and bus system constitutes a branch from this main bus. A train line contactor isolates the car system from the bus, but does not interrupt the bus.

Power connections between cars are made by parallel couplers, one on each side of the car. The train line bus is not interrupted until both coupler connections are broken. Each end of every car has a plug and dummy socket on the right and a main socket on the left. Hence, two cars may be coupled together regardless of how they are faced.

Although there arctually is a difference in the electric circuit as viewed from the two ends of a car, it is possible to couple cars at random in a train. The diagram, Fig. 3, shows two cars faced in one way and one the opposite way.

The only effect of the direct in which the cars are faced is to control the sequence of paralleling. All of the train line relays on cars faced in one direction are operated by the battery on one end car. All relays on cars turned the other way are operated by the battery on the other end car. When the train line control circuits are completed, the relays begin closing in sqeuence at intervals of 10 seconds. If all the cars are faced one way, only one sequence will be set up. If they are coupled at random, two simultaneous sequences will be set up—one in each group of cars. Therefore, not more than two power plants can come onto the line at the same time, and not more than two can come on in any 10-second period.

Completion of the last coupler connection in the train initiates the paralleling sequence. Both coupler connections between each pair of cars must be made up, and the connections on both end cars must be properly made before the control circuits will be complete. Furthermore, when any one connection is broken, all train line relays are instantly opened, and the train line bus isolated within a fraction of a second. This means that no plug can remain hot when its contacts are exposed. Also, because of the parallel connections, no one plug can interrupt the train line power bus. Once one of the two connections is broken, the bus is isolated from all the power plants in the train and the other plug can be pulled without interrupting power on its contacts. The control circuits also pass through a receptacle cover interlock on each end car. Lifting this cover to expose the contacts has the same effect as pulling a coupler plug, instantly isolating the train line bus. This insures that the train line is dead while cars are being coupled.

Each coupler plug carries three control wires, making a total of six train line control circuits between each pair of cars. Actually, there are only two complete circuits involved, each originating and terminating in one end car battery and passing through each coupler plug, and end car coupler cover interlock at least once. The two circuits are so arranged that no two batteries can pe connected in parallel.

Each of the two train line circuits controls the sequence of all cars faced one way electrically. The closing of the contacts of the first relay energizes the train line contactor on that car. A normally open interlock energizes the next train line relay in the sequence to pegin its 10-second timing, and so on. This circuit is connected straight through the cars which are faced in the opposite way, so the sequence is not affected. When a car control switch is in the *OFF* position, it short-circuits the train line contactor interlock and opens the train line sequence relay circuit. When the sequence reaches this car, the relay fails to close; but, because the interlock circuit is completed by the control switch, the sequence passes on to the next car. In this way, the full control of each car system is kept within the car.



Fig. 4—Exhibit panel in General Electric exhibit train used to demonstrate the operation of the undercar power plants

From the point of view of operating personnel, the system is extremely simple. It is only necessary to plug in the train line jumpers at the same time that the air and steam hose connections are made. The paralleling sequence is entirley automatic and no knowledge of the circuits involved is required on the part of the men. The trainman on a car simply turns the control switch to *TL* and he has the power instantly, if power is available in the train, or he turns it to *ENG-TL* and, in addition to power from the train line, in 30 seconds its own power plant is helping to carry the car load.

Dual Plants for All-Electric Diners

If an all-electric diner were to be operated permanently in a train equipped with undercar power plants, it could be equipped with only one set, the same as the other cars. The 50- to 60-kw. load of the diner would be shared by all plants operating on the train line. The probability, however, is that railroads will prefer to have two power plants on a diner so that it may be operated as an independent unit in any type of train or in parallel with similar equipment on other cars. Standard equipment may be used for such installations.

These power plants will be connected to the train line bus in exactly the same way as are separate car systems. The diner load will be shared by all plants on the train line bus. A dual plant load-control scheme enables one plant to be operated continuously, while the other is brought on during periods of heavy load only. This is

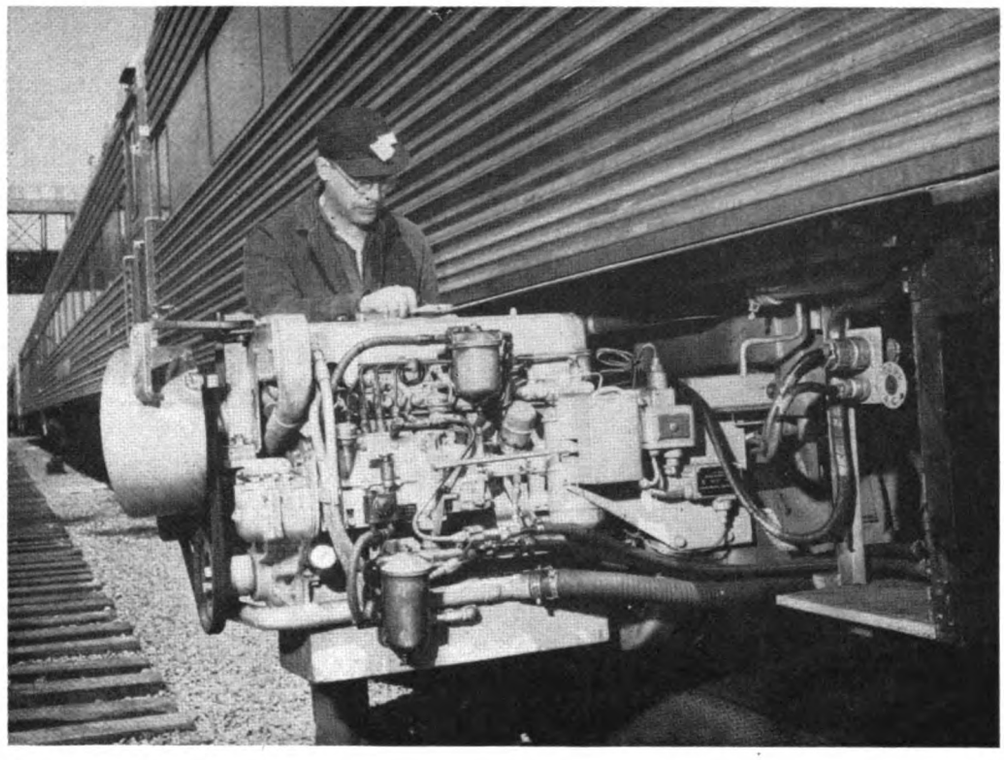


Fig. 5—Undercar power plant swung out for inspection

accomplished by using a standard control for each plant and one small load control panel in addition.

This new system of passenger car power supply has been tested in practical service and has proved to be a much more reliable source of power than if the cars were not paralleled. It also offers other advantages, such as extra reliability and the possibility of shutting down engines not required by the train load. Even when operated as isolated units, this simple control offers numerous advantages. The engine control scheme provides for automatic cranking as well as safety control at the engine box for inspection and maintenance purposes. The engine is automatically protected against overheating, low lubricating oil pressure, and cold starts under load. A separate radiator fan, thermostatically-controlled, assures proper engine operating temperature. The battery-charging equipment is of the simple, dependable static type.

The specially-designed excitation system gives extremely high-speed recovery from all types of line disturbances, thereby minimizing lamp flicker. Circulating current is kept to a minimum, and the voltage setting of the plants is exceptionally stable. The static type voltage regulator employed insures reliable operation and low maintenance. Plants and regulators are interchangeable.

The train line system adopted gives fully automatic paralleling of power plants without complicated and expensive synchronizing equipment. It also insures complete flexibility in train make-up, and retains the independent control of each plant within its own car without affecting parallel operation of other cars.

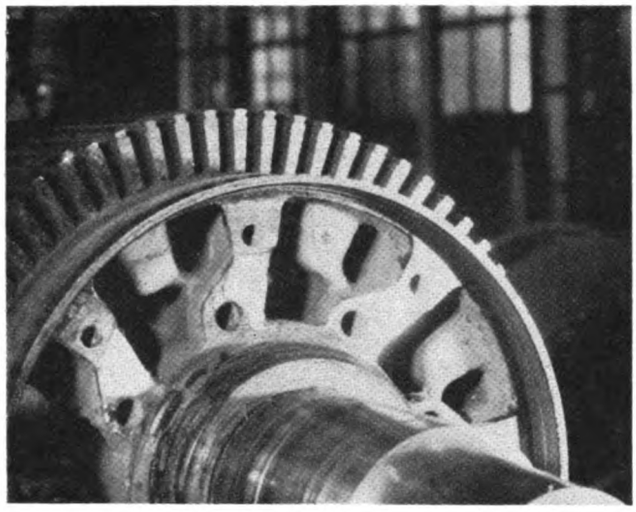
Components of the system have been kept as few in number, and as simple, as possible to promote reliability and reduce maintenance cost.

* * *



One piece of submarine cable being shipped in nine open-top cars from the Okonite Company plant in Paterson, N. J., to Renton, Wash., where it will be used to transmit 25,000-volt power under Puget Sound from Bonneville Dam to the San Juan Islands, Wash. The cable, 4 2/3 in. in diameter, is laid around forms inside the cars, and extended from one car to the next in a vertical loop. Cars are fitted with safety chains, and coupler pins are tack-welded to insure against possible uncoupling

CONSULTING DEPARTMENT



Should Core Slots Be Sand-Blasted?

What shop practices, if any, are necessary to prevent excessive core loss in traction motor armatures?

In production work, we avoid work on the inside of the slots as much as possible by having the iron stacked carefully to produce smooth and clean slots to receive the coils. Perfection is not always possible; consequently, if any of the punchings do project into the slots, we smooth these off by driving into the slot a hardened steel bar or drift which closely fits the slot. Obviously, this operation will smooth down any high spots in the punchings and will localize, to these corrected high spots, any heating due to increased eddy currents caused by the breakdown of insulation resistance between laminations. Special treatment of the laminations forms an insulating medium between punchings and provides resistance to eddy currents in the core.

When this resistance between laminations is destroyed, the eddy current losses do increase. Since sand-blasting would tend to make a continuous current path for eddy currents produced by the cross-slot flux, it is not recommended for clearing up the slot imperfections.

In a real exaggerated condition of misalignment of a few laminations in the core, we might actually hand file to bring the slot to right proportions. In no case do we sand-blast nor do we advocate it.

In the case of reconditioning armatures, where it is necessary to clean out varnish in the slots, we suggest stuffing the slots with rags saturated with benzine or toluol, for softening the varnish so that it can be wiped out manually.

On repair jobs, if an armature is to be rewound and we find that some laminations are high in the slots due to loosening or vibration, we still resort to a hand file to smooth up these local spots. If any corrosion exists, we would try to polish that off by hand. In no case, therefore, do we advocate sand-blasting to clean off dirt or to smooth up slots due to high punchings.

H. E. DRALLE
Westinghouse Electric Corporation

Car Electrical Equipment

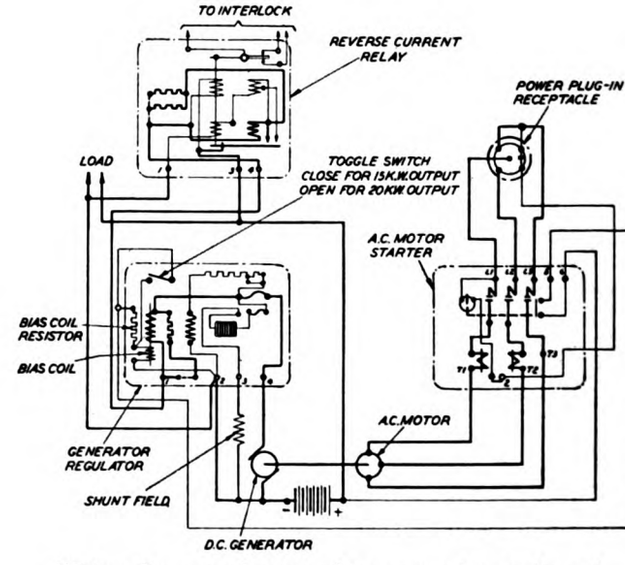
Questions and Answers

Q.—What is a bias coil and why is it used in connection with the genemotor equipment for railway car lighting and air conditioning?

A.—The bias coil is a voltage winding inside of the current coil of the regulator. This bias coil is connected across the battery through an interlock on the a.c. starter panel. When this coil circuit is closed, it influences the current coil arm—in other words, exerts a stronger pull on the current coil plunger.

The bias coil is used on the generator regulator used with a genemotor, which is a d.c. generator in combination with a 3-phase, 60-cycle, 220-volt a.c. motor in a common housing. With this regulator, it is possible to obtain full generator output when the genemotor is being driven from the car axle and then when operating from a.c. standby, the generator output can be reduced to either the capacity of the a.c. motor or the capacity of the a.c. lines. This accomplished as follows:

When the a.c. power plug is inserted, the a.c. starting contactor closes, and at the same time, the normally open interlock to which the bias coil is connected, is also closed, thereby putting this coil directly across the battery. This exerts a certain amount of pull on the current coil plunger even when the current in the current coil is zero. To this pull is added the pull of the current winding when the generator builds up. The result is that the regulator becomes operative at a lower current value than when the bias coil is not in the circuit.



Wiring diagram of a complete genemotor equipment showing the bias coil circuits

it possible for a railroad to select a genemotor having an a.c. motor of the proper capacity. For example, should a train operate over lines where the a.c. lines and circuit breakers at the terminals can handle the maximum output of a 32-hp. motor, then full generator output would be available with a 20-kw. genemotor, equipped with a 32-hp. motor. Should the same train operate over a portion of a line where the a.c. lines could only handle the output of a 20-hp. motor or less, then the generator output could be reduced to the proper value when operating on a.c. standby, by simply cutting the bias coil into the circuit. This is accomplished with a small toggle switch on generator regulator.

In some cases, the a.c. lines or circuit breakers cannot handle more than the output of a 20-hp. motor. Then, if a regulator with a bias coil is used, the railroad can purchase the maximum capacity generator, but equipped only with a 20-hp. motor. This gives them the full advantage of the larger generator when driven from the axle, but limits the standby power to the available power in the circuit. This, of course, results in a lower priced machine.

A. A. DOBIE
Safety Car Heating and Lighting Company, Inc.



Complete specific gravity and voltage readings of the entire battery when on charge is the only way that a true determination of the battery condition can be made

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—Why does a cell read reverse when the engine won't start?

A.—A normal cell will not reverse until it is completely discharged, and the engine refusing to start has no bearing on the reversal of the cell other than completely discharging the cell.

Q.—How hot can a battery get before harm is done?

A.—Standard battery practice is to try to maintain the temperature of the battery below 115 deg. F. Continuous operation of a battery at higher temperature than that can only result in permanent harm to the plates.

Q.—Should battery compartment be ventilated?

A.—Yes. This enables the fumes from the battery to escape and prevents acid fumes from attacking the terminals, connectors and inside of a battery compartment. It helps to keep the battery cool and eliminates a concentration of gas which is highly explosive.

Q.—Why is one battery 1.280 gravity and another 1.250?

A.—The capacity of a battery required for diesel starting determines the specific gravity. The space available for a storage battery has a definite bearing on the specific gravity, as well. If a large plate battery can be used, a lower specific gravity will give longer life and just as good performance. In a small compartment it will be necessary to install a lower plate battery, and then in order to get the required starting current, a higher gravity of 1.280 must be used. An automotive battery must be as small and compact as possible, therefore, small plates are used and higher specific gravity (1.300) is normally used.

Q.—Does it hurt a battery to start the engine if the battery is low?

A.—No. Unless a battery is completely discharged and trying to start the engine completely reverses the entire battery. If there still remains current enough to start the engine, the auxiliary generators will recharge the battery while in service.

Q.—How much drop in specific gravity can be expected over the life of the battery?

A.—A gradual reduction of specific gravity may be expected as the battery ages. This reduction should not exceed 15 to 20 points during the life of the battery, and should be taken into account when the battery is recharged from an outside source.

Q.—What allowable differences between ambient and battery temperature is considered satisfactory operation?

A.—With proper voltage regulator setting, the battery temperature will be within a few points of the ambient temperature. Consistent high battery temperature is an indication of too high a voltage regulator setting.

Q.—How can I determine in advance when a battery should be replaced?

A.—Complete specific gravity and voltage readings of the entire battery when on charge is the only way that a true determination of the battery condition can be made. If there are considerable differences in voltage and gravity between cells, the battery should be shopped. A bench discharge test will then give the actual remaining capacity of the battery and from this test a decision can be made as to whether the battery should be replaced or not.

Q.—What difference in specific gravity between the highest and lowest cell readings would you consider unsatisfactory?

A.—When one or more cells read 20 points or more below the specific gravity of the balance of the cells, an investigation should be made to determine whether the battery is receiving sufficient charge, over-flushed or just what is causing variation between cells.

Q.—What variation in cell voltages, highest to lowest cell readings, would you consider unsatisfactory?

A.—If there is a variation of more than .20 volts between cells, when battery is charging, this would be considered unsatisfactory and the battery should be shopped.

K. A. VAUGHN
Gould Storage Battery Corporation

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

Miscellaneous Equipment

158-Q.—What time is allowable in the yellow zone? A.—Yellow zone operation is permissible for a consecutively or accumulated time not to exceed 90 minutes.

159-Q.—What is permitted in the white zone? A.—Continuous operation.

160-Q.—What type of Speed Transition Meter is used for units having manual transition? A.—The type equipped with two scales.

161-Q.—What do the scales represent? A.—The outer scale is calibrated in miles per hour while the inner scale is marked: 1, 2, 3, and 4, which represents the four transition positions of the selector handle.

162-Q.—What should be done as the speed of the locomotive increases or decreases? A.—The selector handle should be moved to the corresponding position indicated by the pointer.

163-Q.—What type Speeed Transition Meter is used on units having automatic transition? A.—On such units a type is used on which the inner scale is omitted, leaving only the scale for miles per hour.

164-Q.—How many air gauges are furnished and what pressures do they indicate? A.—Two standard air gauges are furnished, one indicating brake cylinder and brake pipe pressure while the other indicates main reservoir and equalizing reservoir pressure.

165-Q.—What minimum battery voltage should be indicated by the Battery Voltmeter with the engine shut down? A.—With the engine shut down and the battery switch closed, the voltmeter should indicate a voltage of 64.

166-Q.—What should a lower reading than this indicate? A.—That the battery is not charged or has faulty cells.

167-Q.—What does the battery voltmeter indicate with the engine running? A.—Auxiliary generator voltage.

168-Q.—What voltage should be indicated under these conditions? A.—The needle should be in the green area at approximately 74 volts.

169-Q.—How does the Auxiliary Generator Ammeter function. A.—It indicates the ampere output of the auxiliary generator and should normally show a slight charge.

170-Q.—What will cause the output to vary? A.—The variation depends on the auxiliaries being operated and the amount of battery charging.

171-Q.—Name some of these auxiliaries. A.—Fuel pump motor, crank case exhauster, motor generator set, eddy current clutch, etc.

172-Q.—At which time will the auxiliary generator ammeter show a high charging rate? A.—Immediately after cranking the engine.

173-Q.—What is the purpose of the Engine Tachometer? A.—This instrument denotes Diesel engine speed.

174-Q.—What is the speed range? A.—350 rpm. idle to 1000 rpm. full engine speed.

175-Q.—What pressure should the Lubricating Oil Pressure gauge indicate at idling speed? A.—20-25 psi.

176-Q.—What pressure at full engine speed? A.—45-60 psi.

177-Q.—What pressure should the Fuel Oil Pressure Gauge indicate? A.—35-45 psi. at all engine speeds.

178-Q.—What is the function of the Booster Air Pressure Gauge? A.—This gauge indicates turbosupercharger air pressure to the Diesel engine.

179-Q.—How much pressure should the gauge show? A.—15-18 psi. with the throttle in the eight notch fully loaded and correspondingly lower values in lower throttle notches.

180-Q.—Where is this gauge on road switchers? A.—Under the hood on the left side of the radiator compartment bulkhead.

181-Q.—How does the Engine Water Temperature Gauge Function? A.—This gauge indicates temperature of the cooling water out of the left bank header of the engine.

182-Q.—What is the normal operating temperature? A.—140 to 160 deg. F.

183-Q.—Where is the Control Air Pressure Gauge located on road locomotives? A.—In the nose on the fireman's bulkhead.

184-Q.—Where is it located on Road Switchers? A.—On the engine control panel.

185-Q.—How much pressure should it indicate? A.—70 psi.

186-Q.—What is the purpose of the Radiator Fan Control Air Pressure Gauge? A.—It indicates the pressure for operation of the electro-pneumatic fan control switches.

187-Q.—Where is this gauge located on road locomotives? A.—It is mounted at the right of the engine control panel on the older models. On the new model 1,600 RFP the gauge is next to the radiator fan control panel.

188-Q.—Where is it located on road switchers? A.—To the right of the fan control under the hood on the left side of the radiator compartment bulkhead.

189-Q.—What pressure should this gauge indicate? A.—15-17 psi.

190-Q.—For what purpose is the main reservoir gauge which is located on road locomotives on the left side wall? A.—It is located near the air compressor governor and is used as a guide in setting the governor.

191-Q.—We have a second water temperature gauge, where is it located and what is the normal operating temperature? A.—It is located in the right engine outlet waterheader near the radiator compartment. The normal operating temperature is 140-160 deg. F.

Alarm and Indicator Lights

192-Q.—When does the Hot Engine Light function? A.—When the temperature of the engine cooling water reaches 185 deg. F.

Steam Locomotive Boilers

By George M. Davies

Height Over Crown Sheet

Q.—What is the most desirable distance between the top of the crown sheet and the inside of the boiler shell at the top; for a locomotive boiler?—R.M.T.

A.—The most desirable distance between the top of the crown sheet and the inside of the boiler shell at the top for a given boiler is that which will permit the largest possible gas area through tubes and flues without restricting the steam space to the extent that there is water carryover into the superheater and cylinders.

Removing Staybolts with Torch

Q.—What is the correct method for removing rigid staybolts with a cutting torch so that the wrapper sheet will not be damaged?—R.E.L.

A.—Staybolts are removed by flame cutting by holding the tip of the cutting torch in line with the bolt so that the preheating flames contact and heat the edge of the telltale hole. When heated sufficiently the oxygen is turned on gradually. The torch is then slowly rotated around the telltale hole until the center of the bolt, for a depth of 3/8 inch, is consumed. The direction of the cut is changed 45 deg. and the bolt pierced through to the water space. By rotating the torch slowly at this same angle the bolt is cut without damage to sheet or threads. The small burr remaining in the threads is then removed, completing the operation.

Water Glass Location

Q.—In complying with Rule 37 which states, "that the lowest gauge cock and the lowest reading of the water glass shall be not less than 3 inches above the highest part of the crown sheet," how often is it required that the distance between the water glass and the top of the crown sheet be checked?—R. E. K.

A.—The height of the crown sheet in a locomotive boiler cannot be termed as permanent due to service conditions and repairs and although there is no rule as to definite intervals at which time the distance between the lowest gauge cock and the lowest reading in the water glass to the top of the crown sheet should be checked it would appear that this distance should be checked, by the methods used by the railroad for locating these parts, after the application of a new rear tube sheet, a firebox removal, or any repairs that could in any way possibly effect the height of the crown sheet.

How To Test Welded Seams

Q.—When applying an all-welded shell to a locomotive boiler what provisions are made for testing the shell, since it is not possible to test the welded seams under pressure at time of construction?—R.E.V.

A.—The all-welded shell is tested under pressure after it is applied to the boiler, it is given the first hydrostatic prior to application of superheater header or units.

The boiler is subjected to a hydrostatic test of 1½ times the designed pressure and while subject to this pressure all butt-welded joints which are unsupported by other means, and all other welded joints where such a test is feasible, is given a thorough hammer or impact test. This impact test consists of striking the plate at 6-in. intervals on both sides of the welded joint and for the full length of all welded joints. The weight of the hammer in pounds shall approximately equal the thickness of the shell in tenths of an inch, but not to exceed 10 lb., and the plate shall be struck with a sharp swinging blow. The edges of the hammer shall be rounded so as to prevent defacing the plates.

Following this test, the pressure should be maintained at not less than one and one-half the designed pressure and held there for a sufficient length of time to enable exterior inspection of all joints and connections.

Pin holes, cracks or other defects should be repaired only by chipping, machining or burning out the defect to clear metal, and re-welding. For gas welding, the metal around the defects shall be pre-heated to a dull red for a distance of at least 4 inches all around. Any preheating means may be used, such as flange fire, gas or oil burner, or a welding torch. The preheating shall be done slowly, so that the heat will get well back into the plate and expand it thoroughly. For metallic arc welding, preheating or reheating is not required. After any repair welding, the area in the vicinity of the weld shall be stress-relieved by heating to a dull red to equalize stresses, and then cooled slowly.

Any repair welding that may be necessary will be performed by a welder qualified in conformance with the requirements of the A.S.M.E. Code. All repair work to welded seams as above specified should be done under the direct supervision of a qualified inspector.

Boiler to be absolutely tight at hydrostatic test.

Following the first hydrostatic test, if repairs have been made to any welded joints, apply hydrostatic pressure of 50 per cent over designed or working pressure. The boiler must be absolutely tight during this test.

If no repairs are made to any welded joint during first hydrostatic test, the second hydrostatic is not required .

Following the hydrostatic tests draw off solution in boiler to reduce water level to about 14 inches above crown, then fire up boiler and test under own steam to 20 per cent above working pressure; the time to be consumed in raising the required steam pressure to be 4½ hr., after which blow back the pressure to 100 lb., then raise the steam again to required pressure and caulk all leaks. Leaks in welded seams in course assembly must not be caulked.

Maintain boiler pressures (20 per cent above working pressure) for about one hour, then cut off burner and allow pressure to drop to 100 lb., blow off all steam pressure slowly before water is drained. Drain boiler. Remove all four corner washout plugs and let boiler stand until absolutely cold, after which the boiler shall be entered and the interor surfaces and connections examined as conditions will permit. Apply superheater header and units and apply hydrostatic pressure of 25 per cent over working pressure to test superheater header and unit joints.

Fire up boiler and test under own steam to 20 per cent above working pressure, water level to be maintained at two gauges and time to be consumed in raising required boiler pressure to be 4½ hr.: and caulk all leaks. Leaks in weld seams in course assembly must not be caulked. (When pressure reaches 100 lb. per square inch, blowout header and units.)

After the second fire test has been successfully completed, blow off the steam pressure and then slowly drain boiler of all contents.

Future repairs to any all-welded seams or liners in shell course assembly, which may become necessary after service of boiler, are to be made in accordance with established practice in the application of repairs to locomotive boilers of conventional construction.

Schedule 24 RL

Air Brakes

OVERSPEED PROTECTION FEATURE — H-24-C RELAYAIR VALVE UNIT (*continued*)

***1080-Q.—What results from air flowing to the chamber over diaphragm* 10?** A.—The diaphragm will move downward seating valve *17* which will prevent the *No 10* line from exhausting to atmosphere through the overspeed application valve.

1081-Q.—Why is this only a temporary suppression? A.—Air in the *17* line can exhaust to atmosphere through choke *2* in the H-24-C relayair valve unit at a predetermined rate, allowing diaphragm *10* of the overspeed suppression valve to move upward opening valve *17*.

1082-Q.—What happens when valve* 17 *is opened? A.—The *No. 10* line is reconnected to the atmosphere through the overspeed application valve and causes a service brake application if the overspeed condition has not been relieved.

1083-Q.—How is a temporary suppression obtained when the emergency application portion is used? A.—By placing automatic brake valve handle in first service, service or lap position while the equalizing discharge valve is open.

1084-Q.—How does this cause a temporary suppression? A.—Brake pipe exhaust is connected through passages *17* and *26*, pipe *26* to passage *17* of the H-24-C Relayair valve unit to the top of diaphragm *10* of the overspeed suppression valve.

1085-Q.—What will bring about a permanent suppression? A.—This is obtained when control pipe *16* pressure reaches about *30* lb.

1086-Q.—Explain how the air in pipe* 16 *causes a permanent suppression. A.—Air flows from the D-24 control valve through pipe *16*, passage *16* and passage *8* in the H-24-C Relayair valve unit, to chamber *D* of the cut-off valve. When the pressure reaches about *30* lb. diaphragm *10* will move downward and close valve *16* which cuts off the *No. 10* line from atmosphere and holds the application portion piston in release position.

HA-24-C RELAYAIR VALVE UNIT

1087-Q.—How many relayair valves are mounted on this unit? A.—Five.

1088-Q.—Name them. A.—Cut-Off Valve; Overspeed Application Valve, Overspeed Suppression Valve; Sanding Valve; and Brake Pipe Cut-Off Protection Valve.

1089-Q.—Two of these valves have not been discussed previously, the Sanding Valve and Brake Pipe-Cut-Off-Protection Valve. How does the Sanding Valve function? A.—The Sanding Valve operates from the D-24 Control Valve (during an emergency application) or from the automatic brake valve (during an overspeed, train control or safety control application) and permits the flow of air to the sanders. It also operates the brake pipe cut-off protection valve.

1090-Q.—How does the Brake-Pipe Cut-Off Protection Valve function? A.—It provides protection against loss of main reservoir air and possible release of the brakes. from an emergency application started from the train when the brake valve handle remains in running position.

1091-Q.—Does this valve protect against loss of main reservoir air caused by a broken main reservoir equalizing pipe? A.—It does not.

1092-Q.—Are these valves interchangeable? A.—Valves *1, 3, 5* and *6* are all interchangeable but valve *4* operates at a different pressure, requiring another type of spring.

1093-Q.—What pressure operates the sanding valve when an emergency application takes place? A.—Emergency reservoir air is connected from the control valve to passage *15*, pipe *15* to passage *15* of the relayair valve unit, to chamber *N* of the sanding valve.

1094-Q.—What then happens? A.—Air in chamber *N* depresses diaphram *10*, opening valve *15*, connecting the volume reservoir, pipe *31*, passage *31* to passage *9* to the sanders.

1095-Q.—What provides the proper blow down time for the sanding reservoir? A.—A choke fitting in passage *9* of the Relayair valve unit.

1096-Q.—What other connection is made from passage 9. A.—Air pressure from passage *9* is also connected to chamber *R* of the brake pipe cut-off protection valve.

1097-Q.—What action then takes place. A.—Air pressure in chamber *R* moves diaphragm *10* down, opening valve *15*, venting passage *10* to the atmosphere.

1098-Q.—What movement takes place when passage 10 is vented? A.—Brake application piston in the brake valve is then moved to application position.

1099-Q.—What desirable result is thus obtained? A.—Communication is thus cut off from the main reservoir to the brake pipe preventing loss of main reservoir pressure.

AUTOMATIC TRAIN CONTROL

1100-Q.—What are the parts required for Automatic Train Control? A.—NS-1 reducing valve; magnet valve; timing valve; stop reservoir; whistle; brake application valve circuit controller; sealed cut-out cock; A-1 suppression valve; acknowledging valve; No. 1 and No. 2 acknowledging reservoirs; suppression reservoir 19; suppression timing reservoir and timing valve reservoir.

1101-Q.—How does the NS-1-reducing valve function? A.—The NS-1-Reducing Valve used with the *C* signal valve, located in the main reservoir pipe to the cab signal magnet is used to reduce main reservoir pressure for use in the cab signal system.

1102-Q.—What is the magnet valve for? A.—For the cab signal system with whistle and acknowledging valve.

1103-Q.—How does the timing valve function? A.—It automatically applies the brake when initiated from a train control application in train stop territory and operates the timing valve whistle and fireman's call signal circuit controller in cab signal territory.

1104-Q.—What is the stop reservoir used for? A.—Connected to the timing valve and the brake valve, it is used to enforce a time interval and insure completion of a stop when a train control application takes effect.

1105-Q.—How does the whistle function? *A.*—The whistle is connected to the timing valve and blows a warning when a train control stop application or cab signal is initiated.

1106-Q.—What is the purpose of the brake application valve circuit controller? A.—To prevent the release of a train control, overspeed or safety control application until after the train has come to a stop, once the application piston moves to service position.

1107-Q.—What is the purpose of the sealed cut-out cock? A.—The cock is located in the pipe between the timing valve and the service piston of the brake valve and cuts out train control operation when it is not desired.

EDITORIALS

A Satisfactory Basis For Diesel Repairs

What is the most satisfactory basis for setting up a program of repairs to diesel locomotives which will assure desired results? Frankly *Railway Mechanical and Electrical Engineer* doesn't know the answer to that question and discerns quite a difference of opinion among various experts in the field. Sometimes diesel motive power is maintained more or less on a time basis which does not take into consideration the use factor, or mileage made. In other cases, inspection and repair periods are scheduled in accordance with mileage figures which apparently overlook the fact that, in the interest of safety, time limits are generally desirable for the replacement of certain parts more or less without regard to the length of service.

It is probable that a combination of the two methods mentioned will best produce desired results which may be summarized as the servicing and maintenance of diesel locomotives in such a way as to give most effective and reliable service at least cost. One thing is sure, namely, that any maintenance program which calls for either inspection or repair and replacement of parts at more frequent intervals than necessitated by their actual condition is an economic waste which railroads can ill afford, not only on account of the extra cost involved, but because badly needed equipment is held out of service that much longer.

Moreover, experience with diesel locomotives shows that parts which are giving entirely satisfactory service sometimes fail soon after being inspected and tampered with by inexperienced or improperly trained workmen. At the January 15 meeting of the Northwest Locomotive Association, this fact was confirmed by an incident cited in the paper on "Diesel Engine Maintenance," by M. Sudheimer, educational director of Electro-Motive. According to the account, the main-bearing shells of a diesel locomotive came due for inspection at a certain shop and a machinist asked his helper to "drop the main bearings." Evidently this helper was quite literal minded for he did just that—dropped all of them from front to back of the engine. The crankshaft came down also and there was no trouble whatever in rolling out the upper halves of the main bearing shells.

After inspection, the main bearings were replaced and tightened again, using the correct torque wrench—but beginning at the rear of the engine, working to the front and neglecting to recheck the rear main bearing for any change in torque reading. It is not surprising that after a short period of service the crankshaft of this locomotive had to be replaced. Even with the most experienced and skillful maintenance forces, it seems reasonable that accurately fitted diesel locomotive parts which give no evidence of trouble and are apparently still well within the service life of the material from a fatigue standpoint should be continued in uninterrupted use. If taken down for inspection and the measurement of infinitessimal wear, there is too much chance that subsequent adjustment may not be as accurate as at first and momentary carelessness may introduce dust or abrasive particles into the wearing surfaces.

"The First Diesel and The Last One, Too"

Back on page 52 of this issue there is a story by one Dave Andrews which purports to be a true narration of the trials and tribulations of a shop gang on a small railroad that had been running "down hill" for several years until its obsolete steam power had reached such a state of disrepair that there was nothing left to do but buy some new power or go out of business. Naturally, the diesel was the answer. The story tells about their introduction to their first diesel.

The real value of such a tale lies in the unconscious recounting of the year-after-year depreciation in the physical condition of a railroad property especially with respect to the facilities used to maintain and service motive power and cars. It's a viscious circle wherein shortsighted management too often trades the few dollars that a sensible policy of shop and terminal improvements would cost against what it thinks is a saving in current equipment maintenance costs and winds up several years later to discover that as motive power and car equipment improve in design or type, inadequate servicing and repair facilities not only cause unnecessary out-of-service time but run up the unit cost of car and locomotive, maintenance as well.

The story brings home the behind-the-scenes difficulties of getting "our first diesel" back on the road with nothing to work with and also shows how foolish it is to expect even the first unit to perform satisfactorily and economically unless, along with its initial cost, is included the collateral appropriation for suitable repair facilities.

Experience with diesel power has demonstrated again and again that the builders' early sales arguments that "you don't need any elaborate shops to maintain a diesel" are pretty well discounted and that any road that tries to economize by getting along without modern repair shops for either its first diesel—or the last one—is heading for a rude awakening when the bills come in. Ten or twelve—or even three hours—of unnecessary out-of-service time is too much penalty to pay on the investment and revenue-producing ability of a $150- or $200-thousand locomotive unit.

Everything That Runs Requires Care

A supervisor at a small servicing point where both steam and diesel power are serviced related an occurrence on his road that unfortunately all too typically represents mechanical-department policy today on many roads, with an appalling financial result. This particular incident concerns cylinder packing for several classes of fairly modern steam power. Before the large-scale adoption of diesel power, when steam locomotives were given somewhere near the attention necessary to assure economical operation, this packing lasted an average of about a year and a half. Today it usually requires renewal monthly.

Dramatic as this reduction in packing life is—to about a twenty-fifth of what it was less than a decade ago when allowance is made for the lower mileage now being turned in by the steam power—it is not half so startling as the fact that nobody seems to care. Everybody seems to be too preoccupied with diesel problems to bother to find out whether the difficulty results from improper water treatment, carrying the water too high while running, poor alignment or any other of a dozen possible causes.

Thus a couple of thousand dollars a year is wasted for each locomotive experiencing this trouble without any time or effort being expended to find the cause and the cure. Surely a little time out could be profitably taken from diesel problems to remedy at least the outstanding steam-locomotive troubles. The preceding case is not an isolated one. Comparable money-wasting difficulties resulting from neglect are common on the majority of steam locomotives today in all parts of the country.

The cost of ignoring the steam locomotive goes beyond the obvious additional expenditure resulting from unnecessarily frequent parts replacement, and the inconvenience of holding the locomotive out of service. It also has a bad effect on the morale of the supervisor who is understandably puzzled by the lack of attention to difficulties that he knows are costing plenty of good money but which he also knows could be eliminated without undue time or effort. The effect of this on his attitude can be easily guessed, as can be the effect on his morale when he finds himself being censured for things that seem much less important.

NEW BOOKS

THE DIESEL-ELECTRIC LOCOMOTIVE HANDBOOK—*Electrical Equipment. By George McGowan, technical consultant. Published by Simmons-Boardman Publishing Corporation, New York. 290 pages, illustrated, 5½ in. by 8¼ in. Fabrikoid binding. Price, $4.95.*

This is the second of a two-book series on the diesel-electric locomotive and is devoted to the electrical equipment of the locomotive. The material is so presented that one man with an ordinary layman's knowledge of electricity will be introduced to the subject with little difficulty.

The book begins by discussing at some length the reason for the adaption of the electrical transmission to the diesel locomotive. The advantages and disadvantages are shown and the subject is developed to indicate the limitations of the equipment used. The reasons for transition of circuits during operation and the necessity for precise operating technique are shown.

Common electrical terms are defined and explained and common electrical formulas given. The various circuits in the locomotive and the reasons why they are necessary are explained. Schematic wiring diagrams are explained and the various symbols used on these diagrams are identified by their function in the electric circuit.

The principles of electric generation are described and the construction and operation of the electric traction generator is explained. With the information given in the electrical fundamentals it is easily shown what troubles may occur to the generator because of overload or improper handling in operation. The traction motors are similarly discussed.

A chapter is devoted to the function of the exciters, auxiliary generators and motor blowers and their relationship to the operation of the locomotive as a whole. Construction details and specific duties are outlined.

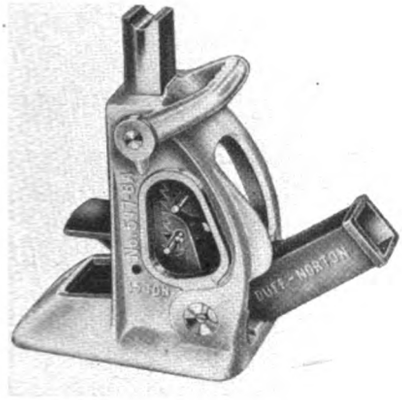
Storage batteries are covered in detail. Their function and duties in the locomotive are outlined and the function of the voltage regulator in relation to the battery is demonstrated. The proper use of the battery and the steps to take to avoid failures in service are pointed out.

The construction and functions of the various types of switches, such as contactors, relays, circuit breakers, magnet valves and interlocks contribute to the subject matter of the last general chapter.

The final chapters, one each for the major builders—American Locomotive-General Electric, Electro-Motive Division, Lima-Westinghouse, Baldwin-Westinghouse and Fairbanks, Morse-Westinghouse—detail the electrical and control equipment separately for these locomotives. The electrical components are described in detail in the first part of each section dealing with a specific builder and the second part is devoted to the control problem met in the specific locomotive being described.

As with the mechanical book, no attempt is made to show any of the electrical equipment of one locomotive in comparison with any other. The information has been checked by the builders for accuracy and completeness of detail. There has been no attempt to offer actual operating instructions, as contrary to good railroad practice, but the information in the general chapters should indicate the reasons for certain specific operating instructions.

NEW DEVICES



Aluminum Housing Track Jack

An aluminum housing which permits a 25 per cent weight reduction is the outstanding feature of the illustrated model 517-BA track jack made by the Duff Norton Mfg. Company, Pittsburgh 30, Pa. Designed for ease in spotting and carrying, this device is light enough to allow section gangs to keep pace with the fast, modern equipment used in surfacing, tamping and aligning operations.

Its base casting is of a special aluminum alloy, but all operation parts are made of heat-treated high carbon steel. A thumb guard prevents injury in tripping, and both upper and lower pawls are spring actuated to prevent accidental tripping. Carrying and spotting are simplified by a bail type handle.

The jack will raise a 15-ton load 5 in. The toe is exceptionally broad, 2½ x 3 in. to keep it from cutting into the ties when a load is applied to the track. The rack measures 1⅝ in. square which is ⅛ in. larger than conventional racks.

Crankcase Oil Tester

According to the Photovolt Corp., New York 16, the Photoelectric Crankcase Oil Tester, Model 75 is the first instrument of its kind permitting definite readings of oil contamination as an indication for the necessity of changing crankcase oil of internal combustion engines.

A few drops of oil from the dripstick are sufficient for the test which can be carried out in less than a minute. Measurements are based on the action of a source of light upon a self-generating photo-cell of the dry-disc type. For operation, the tester can be connected either to an a.c. power line or to a standard 6-volt storage battery.

A handle on the housing makes it convenient to carry the unit which weighs only 9 lb. The photocell is molded and hermetically sealed into polymerized plastic and can be relied upon to give service under unfavorable conditions of atmospheric moisture and chemical vapors.

The only part which requires replacement is the lamp which is easily accessible from the bottom of the unit.

Supercharger Test Apparatus

A development recently put into operation at the Cooper-Bessemer Corp., Mt. Vernon, Ohio, plant, now makes possible complete performance tests of each exhaust-driven supercharger prior to installation on its engine. By means of this unique testing apparatus, each Cooper-Bessemer supercharger is performance-run under conditions of loads and temperatures well in excess of those on the engine for which it has been built.

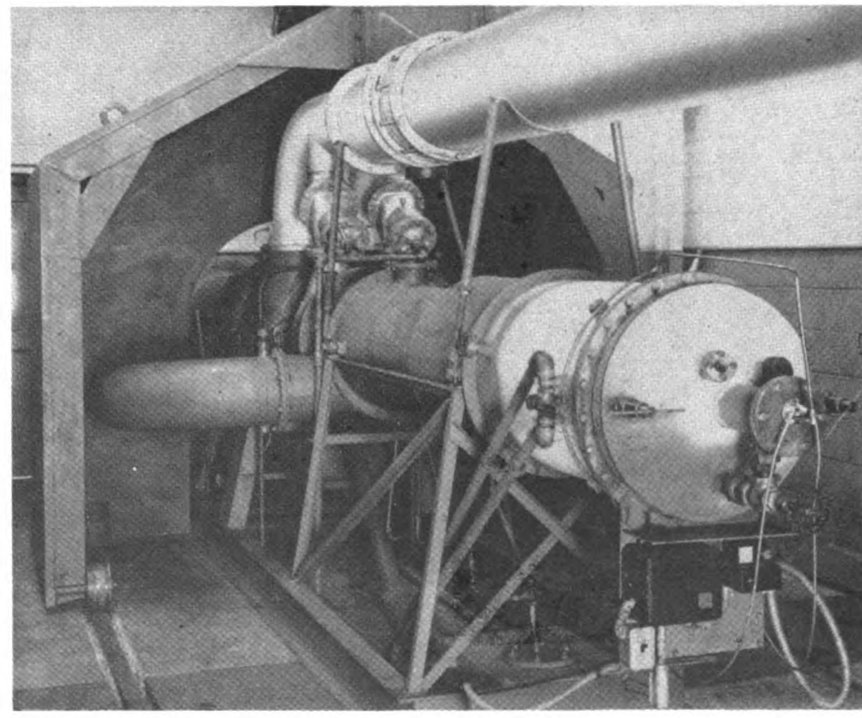
The new rig makes provision for each supercharger to propel itself. In operation, air discharged from the supercharger's centrifugal compressor is directed through an oil fire combustion chamber. The heated air is then piped through the supercharger's gas turbine, driving in turn the same centrifugal compressor unit before being discharged into the atmosphere. Variations in load are, of course, determined by the amount of air discharged from the centrifugal compressor. Temperature is governed by the rate of combustion in the heating chamber.

Installed in its own experimental building this "boot strap" equipment has complete facilities for remote control operation. Seated at the control panel in an adjoining room with visual and recording instruments, the operator can see at a glance the progress of each test.



Chrome Plated Steel Tape Rules

The blades of these tape rules, made by the Lufkin Rule Company, Saginaw, Mich., below the surface, protected against wear These Chrome-Clad, satin-finish blades absorb disturbing light reflections and afford easy reading of all markings and graduations. The blades or measuring device in black markings stand out sharply against the hard, smooth chrome-white surface and they are bonded to the steel and sunk the illustrated tape rules are now part of the Mezurall and Wizard Jr. units. Its are 100 per cent metal, will not chip, crack



or peel and are rust resistant. Balanced construction holds the blades at any length withdrawn and are held in the case by a stop catch guarding against breakage when not in use. Blades are replaceable and have a detaching device that permits replacement in a matter of seconds. Self adjusting end hooks on the rule have an automatic sliding action affording accurate butt-end and hooked-over measurements.

The heavily plated cases for the rules have flush inset side plates in attractive red and white colors.

Control of Insect Infestation in Box Cars

Studies have revealed that the primary source of infestation of food products in box cars is from insects that harbor in accumulations of grain and other organic food materials which accumulate in inaccessible places behind the inner wood wall linings. A method of infestation control in box cars has been developed by Frank S. Bishop, Minneapolis, Minn., in collaboration with a milling company and a railroad company. This system alleviates the infestation by filling the voids behind the inner linings with Fiberglas blankets.

From three to six compartments are formed behind the end lining by the horizontal corrugations in the steel ends, the furring strips and the vertical tongue-and-groove lining boards. Grains or organic dust which gets into these compartments through cracks or small breaks cannot be removed by any cleaning method. No means of eliminating the insect populations harbored and fed by these accumulations has been found.

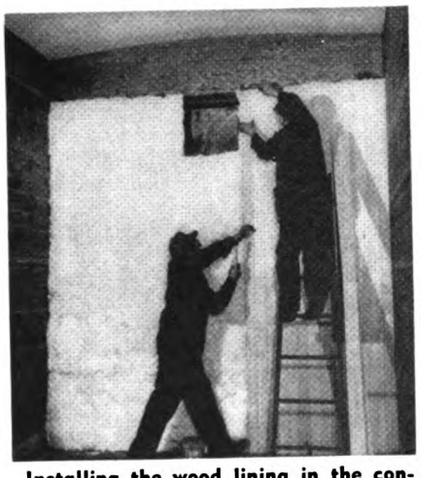
Many box cars are built with the horizontal bottom board left out of the side lining of the car. This permits grain and other organic material which seeps into the space behind these linings to settle out onto the car floor by gravity. Even with these channels open, however, it is possible for accumulations of grain particles and dust to become caked in the



The first step—applying a thick coat of asphalt emulsion to the corrugated-steel ends to prevent rust



The Fiberglas wool blankets are held by large-head nails



Installing the wood lining in the conventional manner

side walls so that they cannot be broken up by hammering the inner lining.

In applying the Bishop System to the ends of a box car the inside surfaces of the steel ends and furring strips are first painted with an asphalt emulsion to protect these areas from moisture. Blankets of Fiberglas wool 2 in. thick, 24 in. wide and as long as the width of the car are then nailed to the furring strips to hold them in place until the wood lining boards have been installed. The lining compresses the wool firmly into all voids in the spaces behind the linings. A similar method is employed in applying the Fiberglas in the side walls of the car.

Installation of the Bishop system in the two ends of a car requires approximately one man hour on the part of two carpenters, and about 180 sq. ft. of Fiberglas wool. The material and labor required to install the Fiberglas in the side walls of the car depends upon the size of the car.

Two tests have been conducted which illustrate the inability of insects to propagate in or to migrate through Fiberglas wool. In one, a layer of infested flour was placed in the bottom of a beaker and separated from a top layer of clean, uncontaminated flour by compressed 2-in. thickness of Fiberglas wool. The insects did not penetrate the wool and the top layer of flour remained uncontaminated after the beaker had stood for months under conditions ideal for propagation.

In the other test a trial installation of the Bishop system was made in the ends of a car in 1947. The side walls were left untreated. After approximately three years of service, during which time the car had traveled to all sections of the country, the end and side linings were removed and the contents of the walls examined in the biological laboratory of a flour mill. The ends of the car, protected by the Bishop System, were found to be free of all forms of infestation. Bottom boards of the untreated sides were removed and large accumulations of grains and organic matter were found. Analysis of this material showed that it contained many live insects which had propagated for several generations.

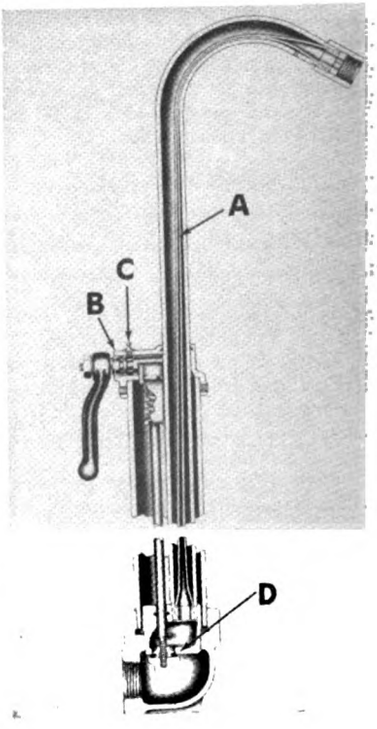
Information relative to the Bishop System of infestation control in box cars may be obtained from Department T, Owens-Corning Fiberglas Corporation, Toledo 1.

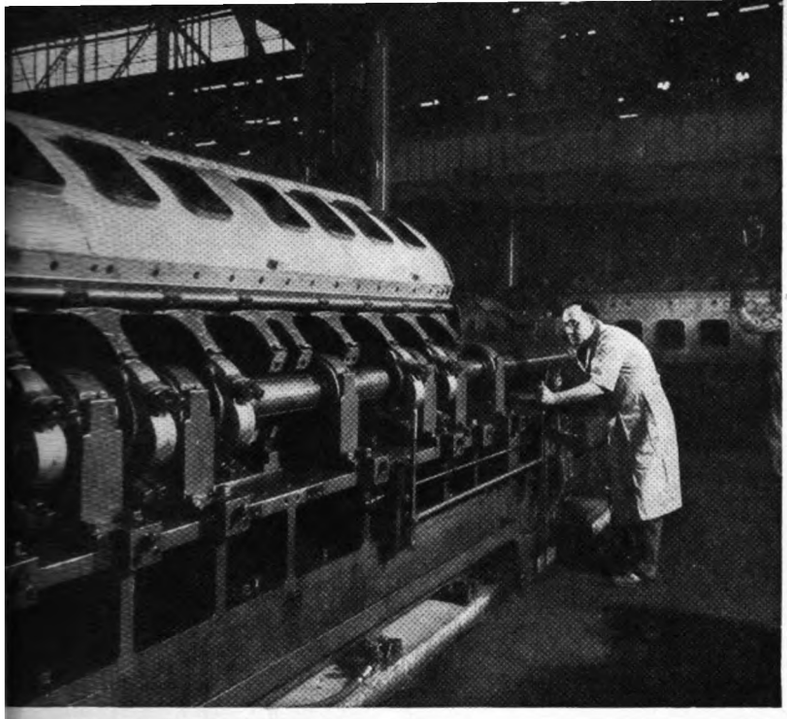
Frostproof Sanitary Water Hydrant

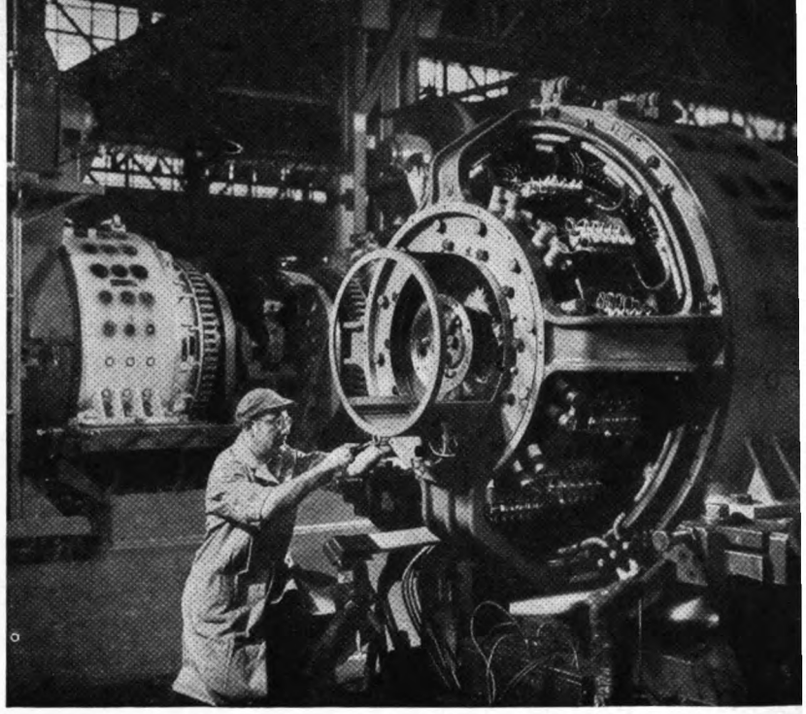
Several design changes have been made in the illustrated water hydrant recently introduced by the Crane Company, Chicago 5. Like its predecessor, the new model features a de-icing tube (A) which eliminates the need for an underground run-off. This tube contracts when the hydrant is not in use and permits only a small amount of water to remain in the spout. Under freezing conditions, this forms a thin ribbon of ice.

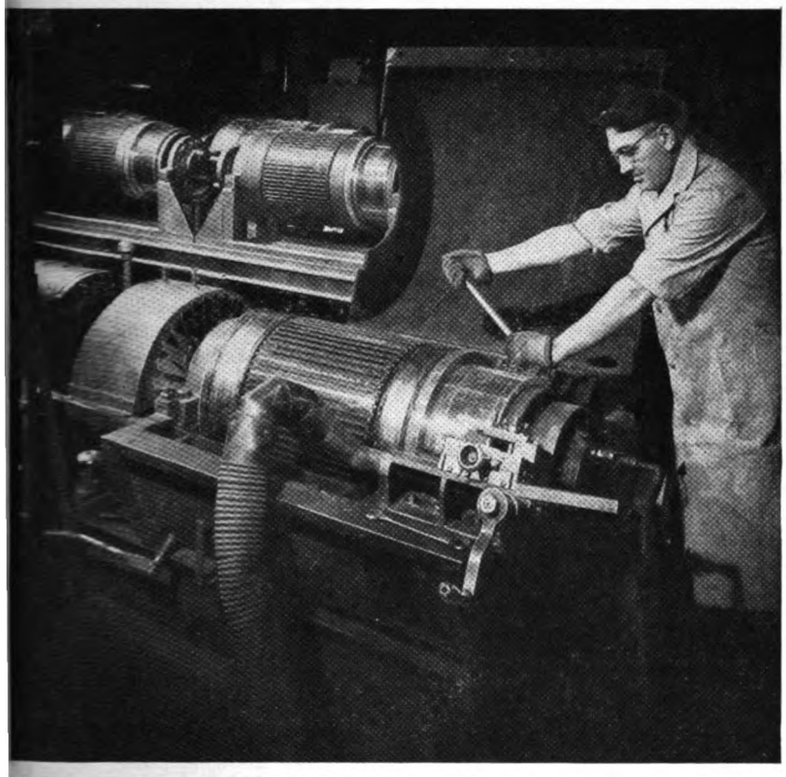
When the operating valve is again opened, incoming water pressure quickly expands the tube away from the ice and forces water around it. This action breaks up the ice and ejects it through the spout. Another

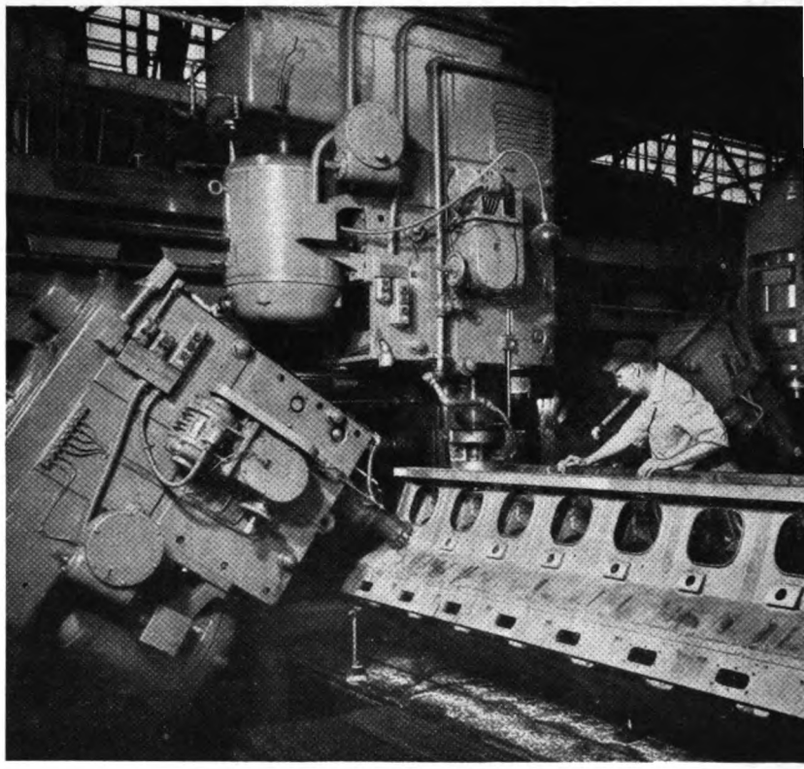
(Continued on page 90)

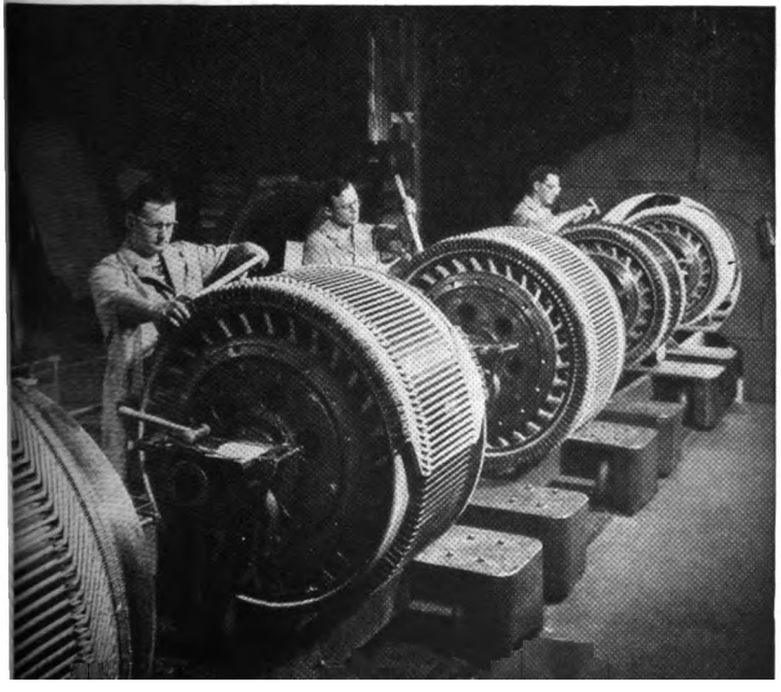


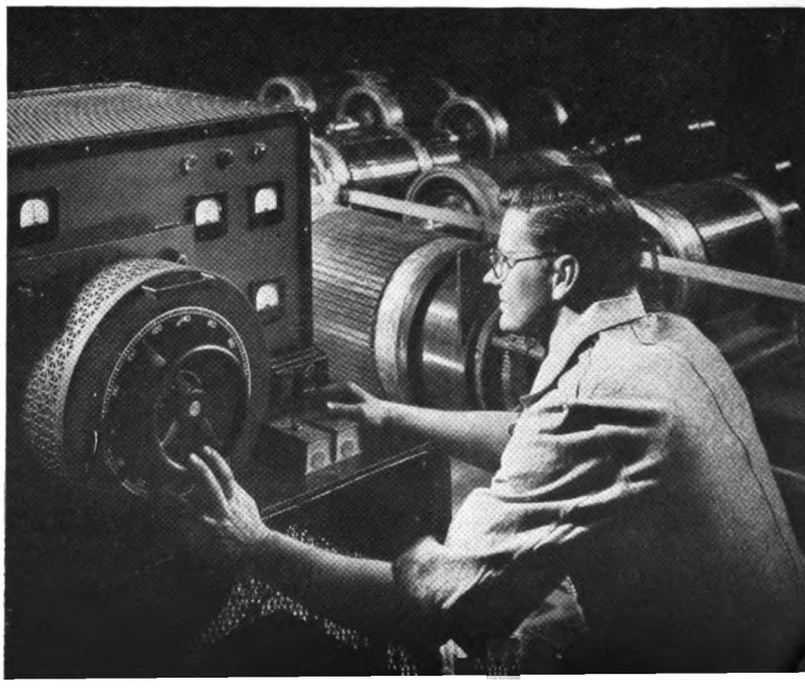












feature is a rubber tubing which gives greater water capacity and eliminates the possibility of leakage at spout inlet.

The entire device above and below ground, is completely sealed against entry of any polluted moisture or matter that might contaminate the water supply.

A new cap design and handle operating mechanism (B) seals out the weather. A grease fitting (C) has been added to provide a means of lubrication. The cone-shaped rubber disc (D) reduces the possibility of foreign matter being entrapped and cutting out the seating surfaces.

The improved hydrants are available for 3, 4 and 5 ft. bury. They are recommended for a working pressure of 100 lb. cold water maximum and a minimum pressure of 30 lb. down to minus 15 deg. F. or 50 lb. down to minus 40 deg. F.

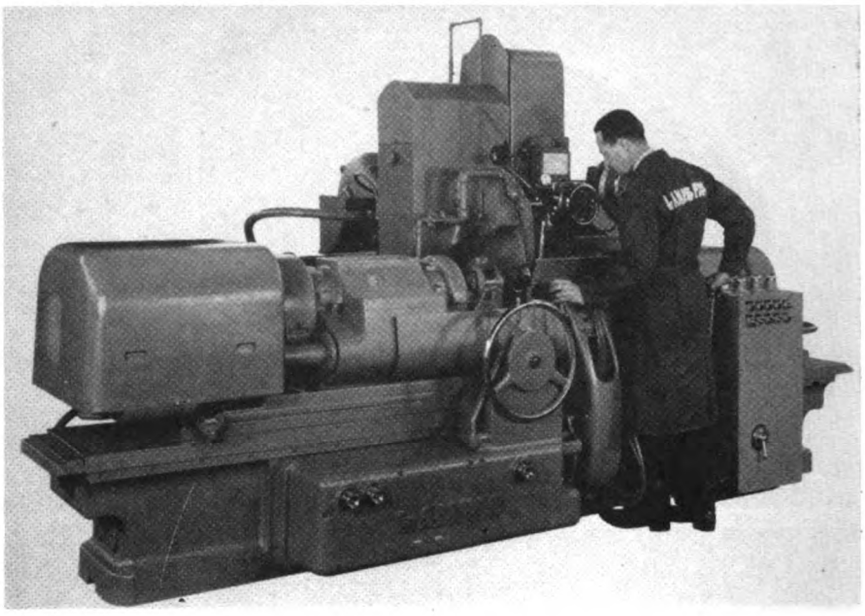
Portable Hot Air Furnace

A fully portable hot air furnace, equipped with an automatic oil burner has been introduced by the Quiet Oil Burner Corp., Newark 4, N. J. Of new design, it includes the fuel saving Catomic adjustable turbulator in the burner nozzle which produces high combustion so that no smoke stack is required.

The unit can be wheeled around from space to space or can be used permanently in one place. To operate, all that is necessary is to plug in the conductor cord to any 110 volt line, attach the hose to the oil drum, hang up the thermostat and turn on the switch.

This device is ideal for heating large spaces such as airplane hangars, railroad round houses, piers and shops. Other applications are for thawing or preheating trucks, tractors and railway rolling stock.

The furnaces are available in several sizes. All burn regular No. 2 grade fuel oil and have stainless steel combustion chambers. A hook on the top is for lifting the complete unit from floor to floor.



Crank Pin Grinding Machine

This unit, designated as the Type DH crank pin grinding machine, is available in swings of 16 or 25 in. and in lengths to accommodate 32, 42 and 72 in. crankshafts. Made by the Landis Tool Co., Waynesboro, Pa., it is used extensively for high production grinding of 4, 6 or 8 cylinder crankshafts.

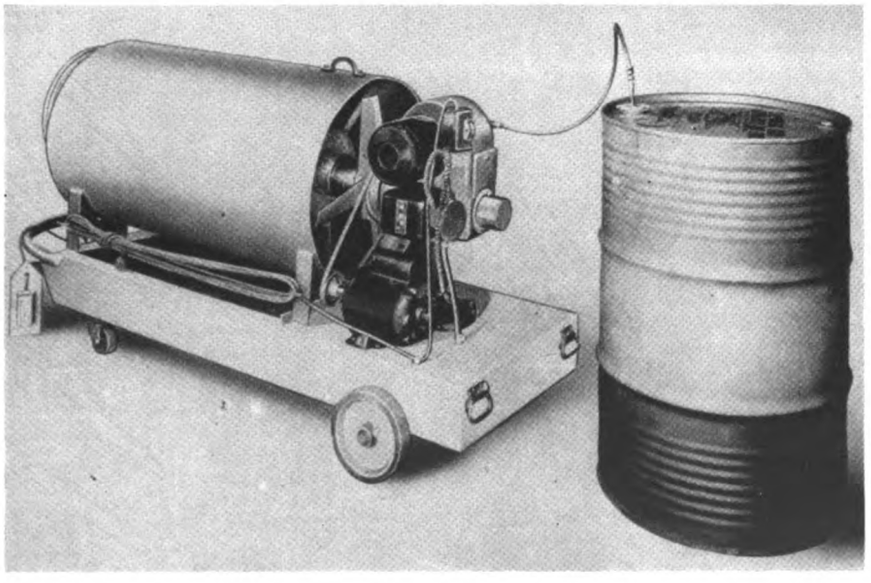
Many refinements to speed production are built into this improved model. Lubrication to the carriage and wheelbase ways is from a separate reservoir with pump and filter. A safety pressure switch prevents operation of the machine unless pressure exists in the system. The carriage ways are fully protected from dirt by telescoping covers which keep the hand-scraped ways protected regardless of the carriage position.

A sensitive hand feed for the carriage is used for positioning the crank shaft laterally as the grinding wheel moves toward the work. Facilities are provided for quick filling and emptying of its fully enclosed oil reservoir as well as gauges to show the oil level.

Speeds of the hydraulic traverse are adjustable at the front of the machine. There are separate controls for positioning speed of the carriage and for both right hand and left hand cushioning speeds.

An overhead type wheel dresser may be obtained to speed the operating cycle. This dresser is hydraulically operated and permits dressing the wheel without changing the work set-up.

A variable speed motor to maintain correct surface speed of the wheel regardless of wheel diameter is available. Automatic sizing is optional equipment.



Transformer Welder

Air Reduction Sales Company, 60 East 42nd street, New York 17, has announced the availability of a new 200-amp. transformer welder. Called the Airco 200-Amp. Model MCX Transformer Welder, it is the latest development in the Wilson line. It is 12 in. by 17 in. by 23 in. high, and is designed to cover a wide range of applications from light duty sheet metal jobs to heavy duty industrial work. It has a full 200-amp., 50 per cent duty cycle, N.E.M.A. rating. Three current ranges selected by insulated tapered plug connectors and hand crank adjustments within each range provide currents from 30 to 250 amp. This permits the use of 1/16-in. to 3/16-in. diameter electrodes. Silicone insulation permits high temperature operation and is water repellant.

This welder employs an automatic hot start control with a hermetically sealed gas-filled, time-delay relay magnetic switch that has no open contact. It is of simple

(Continued on page 120)



"YOU BUY 1 BOX... OR 10,000 BOXES... AT THE SAME LOW FLAT PRICE PER BRUSH!"

BECAUSE WE'VE STANDARDIZED NATIONAL TRADE-MARK CARBON BRUSHES

FOR DIESEL-ELECTRIC LOCOMOTIVE EQUIPMENT!

YOU PAY the same low, flat price regardless of how many brushes you buy, providing you buy one box or multiple thereof. You get fast delivery because these brushes are kept in stock in large supply. You get better quality because of manufacturing refinements made possible by mass production economies. You get a brand new package — sturdy, attractive, easy to store and handle.

Why is this possible? Because we have STANDARDIZED "NATIONAL" brushes for all motors and generators commonly used on diesel-electric locomotives. We have picked the best brushes in the field for dependable operation under severe and varying conditions. We have made them with top performance grades and still stronger connections — made them better in many ways — and we are now making these brushes in quantity. The list of STANDARDIZED diesel-electric brushes follows:

BRUSH NO.	SIZE (INCHES)	GRADE
	FOR TRACTION MOTORS	
NC 24-7215	2 x 2¼ x ¾ (⅜-⅜)	"Plytek" Grade AZY
NC 24-7213	2 x 2¼ x ¾ (⅜-⅜)	"Plytek" Grade AX-5
NC 24-5620	2 x 1¾ x ¾ (⅜-⅜)	"Plytek" Grade AZY
NC 24-5619	2 x 1¾ x ¾	Grade AX-5
NC 20-6420	2⅛ x 2 x ⅝ (5/16-5/16)	"Plytek" Grade AZY
NC 20-6419	2⅛ x 2 x ⅝ (5/16-5/16)	"Plytek" Grade AJH
NC 32-5204	2¼ x 1⅝ x 1	Grade AX-5
	FOR MAIN GENERATORS	
NC 24-4024	2½ x 1¼ x ¾ (⅜-⅜)	"Plytek" Grade 255
NC 24-4009	2½ x 1¼ x ¾ (⅜-⅜)	"Plytek" Grade SA-45
NC 12-4819	2¼ x 1½ x ⅜	Grade SA-35 (30/30 Bevel)
NC 20-4202	2 9/16 x 1 5/16 x ⅝ (5/16-5/16)	"Plytek" Grade SA-3590
NC 20-5633	2¼ x 1¾ x ⅝ (5/16-5/16)	"Plytek" Grade SA-3590
NC 12-4812		
NC 12-4813	2¼ x 1½ x ⅜	Grade SA-35 (35/10 & 35/30 Bevels)
NC 13-5101	2¼ x 1.580 x .400	Grade AX-5
	FOR AUXILIARY EQUIPMENT	
NC 20-3220	2 x 1 x ⅝	Grade 259
NC 16-3220	1¾ x 1 x ½	Grade SA-3538
NC 16-5622	1¾ x 1¾ x ½	Grade 259
NC 08-3216	1¾ x 1 x ¼	Grade SA-45

The terms "National", "Plytek" and the Three Pyramids Device are registered trade-marks of

NATIONAL CARBON COMPANY • **Division of Union Carbide and Carbon Corporation**

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NEWS

Allied Railway Supply Exhibit

TENTATIVE arrangements are being made by the Allied Railway Supply Association, for holding exhibits during the meeting of the Coordinated Mechanicl Associations at the Sherman Hotel, Chicago, September 17 to 20. The Electrical Section, A.A.R., will meet at the same time at the La Salle Hotel. Details concerning the exhibit may be had by writing to the secretary of the supply association, P.O. Box 5522, Chicago 80.

May Locomotive and Car Programs

THE National Production Authority has approved allocations, including 36,600 tons of steel, for locomotive building and 288,500 tons for freight cars in May. The program contemplates a May production of about 300 locomotives.

The freight car program, which has been on a 10,000-car monthly basis since it was inaugurated in January, will become a 9,000-car program in May. The N.P.A. has advised participating steel producers that May allocations for the program will total 288,500 tons of steel. This compares with monthly allocations of 310,000 tons during this year's first four months. It is understood that the Defense Transport Administration is undertaking to have the cut restored.

Samuel R. Lewis Receives Anderson Medal

SAMUEL R. LEWIS, consulting mechanical engineer of Chicago, and the author of several textbooks on engineering as well as of numerous technical papers and engineering articles, including "Railway Air Conditioning" and "Air Conditioning and Refrigeration," has been awarded the 1950 F. Paul Anderson Medal of the American Society of Heating and Ventilating Engineers for "outstanding contributions to the advancement of heating, ventilating and air conditioning."

Bureau of Safety Report

THE annual report of Director S. N. Mills of the Interstate Commerce Commission's Bureau of Safety for the fiscal year ended June 30, 1950, has been submitted to the commission and sets forth in the usual form the results of inspection of safety-appliance equipment on railroads, together with information on hours of service of railroad employees, installation and inspection of signal systems, interlocking and automatic train-stop and train-control devices, investigation of accidents, prosecutions for violations of railroad safety laws and other activities of the bureau.

During the year under review, 1,149,879 freight cars, 29,533 passenger-train cars and 12,647 locomotives were inspected, as compared with 1,072,219 freight cars, 27,481 passenger-train cars and 12,044 locomotives in fiscal 1949. Of the 1950 total, 3.37 per

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MARCH ISSUE

DIESEL-LOCOMOTIVE ORDERS

Road	*No. of units*	*Horsepower*	*Service*	*Builder*
Akron & Barberton Belt	1	1,200	Switch	Baldwin-Lima-Hamilton
Calumet & Hecla Consolidated Copper Co.	1	1,200	Switch	Baldwin-Lima-Hamilton
Kansas City Southern	4	1,200	Switch	Baldwin-Lima-Hamilton
Louisville & Nashville	10[1]	1,500	Road	Electro-Motive
	31[1]	1,500	Freight	Electro-Motive
	12['B']	1,500	Freight	Electro-Motive
	4[1]	1,500	General purpose	Electro-Motive
	10[1]	1,200	Switch	Electro-Motive
Rutland	5[2]	1,600	Road-switch	Alco-G. E.
New York Central	22['A']	2,250	Passenger	Electro-Motive
	131['A']	1,500	Freight	Electro-Motive
	7['B']	1,500	Freight	Electro-Motive
	27	1,500	Road switch	Electro-Motive
	11	1,200	Switch	Electro-Motive
	6	800	Switch	Electro-Motive
	62['A']	1,600	Freight	Alco-G. E.
	32['B']	1,600	Freight	Alco-G. E.
	27	1,600	Road switch	Alco-G. E.
	13	600	Switch	Alco-G. E.
	8['A']	2,400	Passenger	Fairbanks, Morse
	4['B']	1,600	Freight	Fairbanks, Morse
	8['A']	1,600	Freight	Fairbanks, Morse
	18['A']	1,600	Freight	Baldwin-Lima-Hamilton
	8['B']	1,600	Freight	Baldwin-Lima-Hamilton
	3	1,200	Switch	Baldwin-Lima-Hamilton
Canadian National	12	800	Switch	General Motors Diesel, Ltd.
	12	660	Switch	Montreal Loco. Wks.
Sharon Steel Corp.	8	800	Switch	Baldwin-Lima-Hamilton
	1	1,200	Switch	Baldwin-Lima-Hamilton
Wabash	2	1,200	Switch	Baldwin-Lima-Hamilton

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Atchison, Topeka & Santa Fe	500	70-ton gondola	Company shops
Atlanta & West Point	90	50-ton box	Pullman-Standard
Cambria & Indiana	400	50-ton hopper	Bethlehem Steel
Canadian National	50[3]	Box	Eastern Car Co.
	1,500[3]	70-ton gondola	Eastern Car Co.
	500[3]	70-ton hopper	National Steel Car Corp.
	300[3]	50-ton flat	National Steel Car Corp
Chattahoochee Valley	10	50-ton pulpwood	Company shops
Chesapeake & Ohio	200[4]	70-ton covered hopper	Pullman-Standard
Chicago & Eastern Illinois	100	50-ton box	American Car & Fdry.
Duluth, Missabe & Iron Range	1,500	70-ton ore	Pullman-Standard
Erie	500	70-ton gondola	Greenville Steel Car
	500	50-ton box	Company shops
Georgia	110	50-ton box	Pullman-Standard
	100	50-ton hopper	Pullman-Standard
Illinois Terminal	25[5]	70-ton gondola	Greenville Steel Car
Merchants Despatch Transportation Corp.	1,000	40-ton refrigerator	Company shops
Richmond, Fredericksburg & Potomac	100	50-ton box	Pullman-Standard
Western of Alabama	50	50-ton gondola	Pullman-Standard

FREIGHT-CAR INQUIRIES

Great Northern	700-1,000	70-ton ore
Northern Pacific	250	70-ton gondola
Western Maryland	1,000	55-ton hopper

PASSENGER-CAR INQUIRIES

Road	*No. of cars*	*Type of car*	*Builder*
Chicago, Burlington & Quincy; Denver & Rio Grande Western; Western Pacific	22[6]	Sleeping	

[1] For delivery by October, except the general-purpose locomotives which are expected to be delivered in January, 1952.

[2] Estimated cost $750,000. Two units delivered. Delivery of a third expected in April, and the remaining two in June.

[3] Delivery of the box cars scheduled for the latter part of this year. Delivery of the other cars to begin in December.

[4] Delivery scheduled for 1952. Estimated cost $1,400,000.

[5] For delivery early next year.

[6] Equipment includes 12 6-section-6-roomette-4-double bedroom cars, six 6-double bedroom-5-compartment cars (three for the Burlington, two for the W. P. and one for the D. & R. G. two 6-double bedroom-10 roomette and one dome-room-observation car and one 16-section car, all of stainless steel.

NOTES:

Southern Pacific.—The S. P. has authorized purchase of 5,500 box, 1,000 gondola and 500 hopper cars.

Pittsburgh's Alkali and Acid-Resistant

CARHIDE...

Provides better protection and longer life for covered hopper cars!



● One of the hundred covered hopper cars refinished with alkali- and acid-resisting CARHIDE in use for more than a year by the Rock Island Lines.

YOU can now give added years of service to covered hopper, refrigerator and tank cars with Pittsburgh's alkali- and acid-resisting CARHIDE.

● **This new product** of Pittsburgh's leadership in paint research now makes possible an entirely new degree of protection against the effects of cargoes which quickly destroy ordinary finishes.

● **A number** of leading railroad lines have tested this finish on several hundred cars for periods from one to three years with highly satisfactory results. Tests have demonstrated that such ladings as soda ash, sulphur, phosphates, cement, lime, common salt, alkalis, crude oil and alcohol will not affect it. Furthermore, it has shown high resistance to abrasion as well as to repeated scrubbings.

● **This new CARHIDE** dries as quickly as lacquer—you can maintain one-day finishing schedules.

● **If your line** has cars used to carry corrosive cargoes it will pay you to investigate this new alkali- and acid-resistant CARHIDE. Call on us for suggestions and advisory service.

PITTSBURGH PLATE GLASS COMPANY
Industrial Paint Division, Pittsburgh, Pa.

Factories: Milwaukee, Wis.; Newark, N. J.; Springdale, Pa.; Houston, Texas; Los Angeles, Calif.; Portland, Ore. Ditzler Color Division, Detroit, Mich. The Thresher Paint & Varnish Co., Dayton, Ohio. Forbes Finishes Div., Cleveland, Ohio. M. B. Suydam Div., Pittsburgh, Pa.

Pittsburgh Railway Finishes For Every Need

CARHIDE—for wood and metal freight cars of all types.

LAVAX SYNTHETIC ENAMELS—for locomotive and passenger cars.

STATIONHIDE—adds beauty and attractiveness to stations.

IRONHIDE—for iron and steel fixed properties.

SNOLITE—white fume-proof paint for signs, crossing gates, fences and cattle guards.

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cent of the freight cars, 3.74 per cent of the passenger-train cars and 3.41 per cent of the locomotives were found to be defective, as compared to the respective 1949 figures of 3.21 per cent, 3.28 per cent and 4.12 per cent.

Air brakes tested on 2,826 trains (consisting of 124,708 cars) prepared for departure from terminals were found operative on 124,576 cars, or 99.9 per cent. This percentage was attained, however, after 2,364 cars having defective brakes had been set out and repairs had been made to brakes on 2,045 cars remaining in the trains. Similar tests on 1,530 trains arriving at terminals with 85,135 cars showed that air brakes were operative on 97.8 per cent of the cars and that an average of approximately 1.2 cars per train were not controlled by power brakes.

According to the report, 703 reporting railroads and private car lines, which collectively own 2,152,320 freight cars, have equipped 1,907,812 such cars with power brakes which comply with specifications set out in the commission's September 21, 1945, order, as amended August 27, 1948, October 10, 1949, and October 10, 1950.

As of June 30, 1950, 89.8 per cent of railroad-owned cars, and 80.5 per cent of cars owned by private car lines, were equipped. In the matter of geared hand brakes, the report noted that the Association of American Railroads has issued certificate of approval for 28 types—15 vertical wheel types, 10 horizontal wheel types, and 3 lever types.

Rules for Self-Propelled Cars Will Be Considered

THE Interstate Commerce Commission has instituted an investigation "to determine what, if any, rules and instructions should be prescribed for the inspection and testing of self-propelled units of equipment . . . in multiple-unit service operated by a single set of controls." All Class I railroads have been made respondents in the proceeding which is docketed as Ex Parte No. 179.

Petitions asking that present locomotive inspection rules be extended to include multiple-unit cars were filed with the commission recently by the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen. (See *Railway Mechanical and Electrical Engineer*, March 9, page 90.)

Miscellaneous Publications

SYMPOSIUM ON RAPID METHODS FOR THE IDENTIFICATION OF METALS.—American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. 84-page publication (STP No. 98), bound in heavy paper. Price, $1.75. This symposium, sponsored by Committee E-3 on Chemical Analysis of Metals, covers the most recent developments in the field of rapid methods for the identification of metals. It comprises nine papers as follows: Development, Present State, and Outlook of Spot Test Analysis, by Feigl, Laboratorio da Producao Mineral, Ministerior da Agricultura, Rio de Janeiro, Brazil; Electro Spot Testing and Electrography, by H. W. Hermance and H. V. Wadlow, Bell Telephone Laboratories; Instruments for Rapid Metal Identification, by R. R. Webster, Jones & Laughlin Steel Corporation; Separating Alloys by Relative Spot Tests, by H. Kirtchik, General Electric Company; Rapid Methods for the Identification of Copper-Base Alloys, by R. P. Nevers, American Brass Company; Rapid Identification of Metal Finishes, by A. Lewis and D. R. Evans, Western Electric Company; Examination of Plated and Protective Coatings by Electrographic Analysis, by N. Galitzine and S. E. Q. Ashley, General Electric Company; A Field Test Kit and Procedure for Use in the Rapid Identification of Some Nickel Alloys and Stainless Steels, by H. B. Lea, Eastman Kodak Company, and Rapid Tests for Identifying Alloy Steels, by E. C. Kirkham, University of Utah.

◆

TYPES OF LOCKNUTS AND THEIR PRINCIPLES OF OPERATION. Published by Locknut Section, Industrial Fasteners Institute, Cleveland, Ohio. 18-page, illustrated paper-covered booklet. Discusses the advance of the locknut during the past decade, and briefly describes various types of modern locknuts and their principle of operation.

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of November 1950	Month of November 1949	11 months ended with November 1950	11 months ended with November 1949
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	29,011	29,566	317,821	361,164
3-06	Total, Diesel-electric	19,271	14,401	191,774	137,893
3-07	Total, electric	798	756	9,087	8,733
3-04	Total, locomotive-miles	49,089	44,726	518,749	507,814
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,696	1,466	17,924	16,419
4-06	Empty, total	868	812	9,327	9,285
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	48,415	45,847	530,458	566,323
6-02	Total in oil-burning steam locomotive trains	13,425	13,816	141,809	163,594
6-03	Total in Diesel-electric locomotive trains	53,928	40,178	543,846	393,604
6-04	Total in electric locomotive trains	2,158	2,029	24,229	23,443
6-06	Total in all trains	117,966	101,886	1,240,644	1,147,092
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.05	1.05	1.05
10-02	Loaded freight car-miles	38.40	36.70	38.60	36.30
10-03	Empty freight car-miles	19.70	20.30	10.10	20.60
10-04	Total freight car-miles (excluding caboose)	58.10	57.00	58.70	56.90
10-05	Gross ton-miles (excluding locomotive and tender)	2,673	2,550	2,673	2,537
10-06	Net ton-miles	1,242	1,152	1,224	1,141
12	Net ton-miles per loaded car-mile (M-211)	32.30	31.40	31.70	31.40
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	66.10	64.40	65.80	63.90
14	Averages per train hour (M-211):				
14-01	Train miles	16.70	16.90	16.90	16.90
14-02	Gross ton-miles (excluding locomotive and tender)	43,949	42,558	44,471	42,377
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	46.40	42.20	45.30	41.90
14-02	All	44.00	39.30	42.50	39.40
15	Average net ton-miles per freight car-day (M-240)	941	793	885	791
17	Per cent of home cars of total freight cars on the line (M-240)	37.00	45.40	41.30	50.00
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	11,310	12,067	128,382	169,823
3-06	Diesel-electric	15,062	13,380	160,774	139,200
3-07	Electric	1,572	1,569	17,605	18,111
3-04	Total	27,945	27,016	306,762	327,248
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	269,256	261,018	2,955,677	3,072,231
4-09	Total in coal-burning steam locomotive trains	61,442	62,862	666,196	888,676
4-10	Total in oil-burning steam locomotive trains	34,474	37,966	403,440	479,619
4-11	Total in Diesel-electric locomotive trains	156,442	142,697	1,696,601	1,505,499
12	Total car-miles per train-miles	9.47	9.38	9.44	9.19
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,435	1,365	15,664	19,035
1-02	Steam, oil-burning	279	256	2,757	3,021
1-03	Diesel-electric[1]	2,752	2,085	27,591	21,785
1-06	Total	4,494	3,731	46,314	44,128
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	53	70	634	983
2-02	Steam, oil-burning	15	13	149	168
2-03	Diesel-electric[1]	237	219	2,515	2,295
2-06	Total	339	337	3,673	3,832
3	Hours per yard locomotive-day:				
3-01	Steam	8.80	7.20	8.10	8.10
3-02	Diesel-electric	18.00	16.90	17.50	17.10
3-05	Serviceable	14.80	13.60	14.20	13.30
3-06	All locomotives (serviceable, unserviceable and stored)	12.90	10.80	12.00	11.10
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.84	1.78	1.79	1.86
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.78	0.80	0.77	0.77

[1] Excludes B and trailing A units.



for an XL Ride THAT Protects LADING AND ELIMINATES DAMAGE CLAIMS



THE New MINER XL Ride Snubber CLASS C-4-S

W. H. MINER, INC., CHICAGO

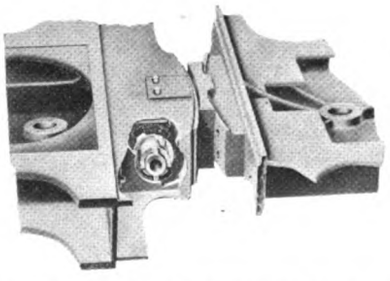


CUT locomotive maintenance COSTS

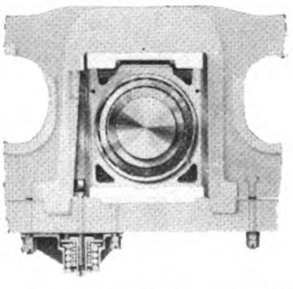


with these TWO SHOCK ABSORBERS

The Franklin E-2 Radial Buffer The Franklin E-2 radial buffer reduces maintenance by dampening and absorbing horizontal shake and vertical vibration. This results in less wear on chafing plates, drawbars and pins; fewer pipe failures; less displaced brickwork; and fewer loose cabs. It requires minimum attention and will make any locomotive, at any speed, a better riding engine. Crews appreciate the greater comfort it brings.



The Franklin Compensator and Snubber—Equally important with roller-bearing or surface-bearing locomotives, the Franklin Compensator and Snubber keeps the driving box or housing snug in the pedestal jaw, regardless of expansion or wear. It will absorb unusual thrusts and shocks. Driving box pound is eliminated. Wear and the possibility of failure of crank pins and rod bearings are minimized. Tire mileage is extended by reduction of quarter slip.



REG. U.S. PAT. OFF.

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER
POWER REVERSE GEARS • FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS
JOURNAL BOXES • FLEXIBLE JOINTS • TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

SUPPLY TRADE NOTES

TURCO PRODUCTS, INC.—*D. T. Buist* has been appointed national sales director of Turco Products, Inc., to succeed *Lou H. Moulton*, vice-president and national sales director, who recently retired. *Stewart B. Van Dyne* has been appointed administrative assistant and *D. T. Miller* as coordinator of sales, both newly created positions.



L. H. Moulton

Mr. Buist joined Turco in 1936 after 20 years of experience in the automotive field, and has worked successively as service engineer, district sales manager, western zones sales manager, and, most recently, as assistant national sales director.



D. T. Buist

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*Robert C. Augur*, consulting editor, Locomotive Cyclopedia and Car Builders' Cyclopedia—publications of the Simmons-Boardman Publishing Corporation—has retired. Mr. Augar was born on June 24, 1866, at New Haven, Conn. He attended Hillhouse High School, New Haven, and is a graduate of Sheffield Scientific

The Proof of a Product is its Endorsement



Experience has proved that Ex-Cell-O hardened and ground steel pins and bushings last longer. That's why so many American railroads have standardized on Ex-Cell-O products. They have found that by resisting road shock and vibration, Ex-Cell-O pins and bushings reduce wear on costly foundation parts; cut out-of-service time to a minimum; frequently give from four to six times longer service than other pins and bushings. Standard styles and sizes for steam, Diesel and passenger car equipment are listed in Ex-Cell-O Bulletin 32381. A free copy is yours on request.

XLO
EX-CELL-O for PRECISION

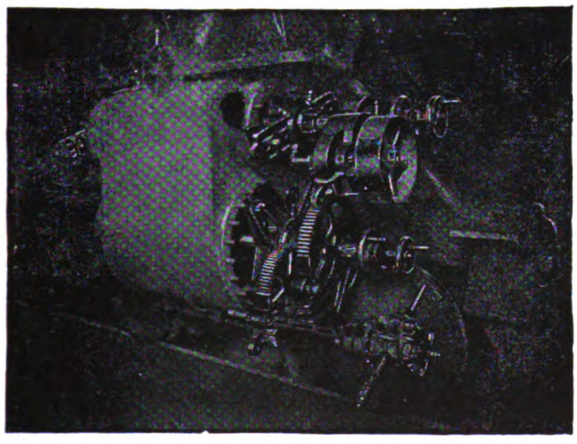
HARDENED AND PRECISION GROUND
STEEL PINS AND BUSHINGS

51-16

Railroad Division **EX-CELL-O CORPORATION** Detroit 32, Michigan

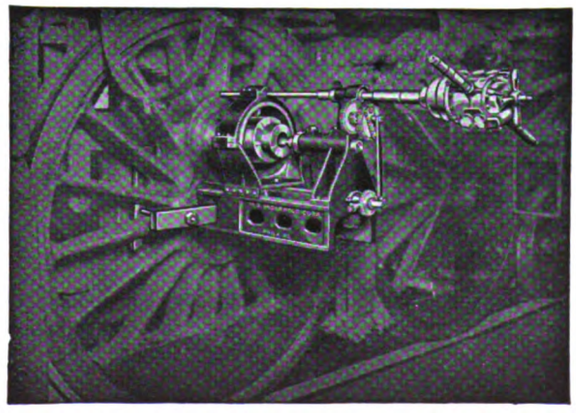
UNDERWOOD PORTABLE MACHINE TOOLS

For Railway Shops and Engine Houses



Left: The Underwood Boring Bar illustrated is designed for reboring all sizes of locomotive cylinders and valve chambers.

Below: The Underwood Portable Crankpin Turning Machine returning crankpin in position.



OTHER UNDERWOOD TOOLS:

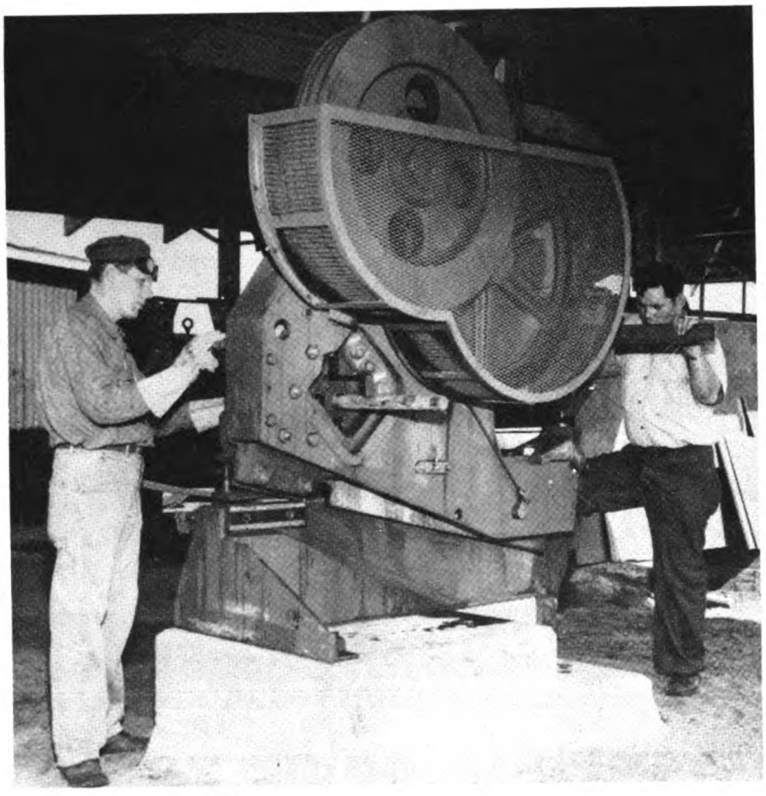
- Portable Facing Arms
- Rotary Planing Machines
- Locomotive Cylinder or Dome Facing Machine
- Portable Pipe Benders
- Rotary Flue Cleaner

H. B. UNDERWOOD CORPORATION, PHILADELPHIA 23, PA., U. S. A.

FLORIDA EAST COAST Railway



Keeps 'Em ON SCHEDULE



"Buffalo" UNIVERSAL IRON WORKER

Helps Keep Maintenance on Schedule

Above, the "Buffalo" U.I.W. in the St. Augustine Shops of Florida East Coast Railway is simultaneously cutting bar and notching angle. Here's a multi-purpose machine that turns out scores of fabricating jobs in a hurry.

"One of the best labor-saving devices we ever purchased . . ."

. . . that's the word of the Maintenance of Way Engineer of this progressive road. And users in steel mills, other heavy industries, give the same report. For here, in one machine, you can punch, shear angles, cut bars, slit plates, notch and cope—and do it at full speed 24 hours a day. A U.I.W. will pay for itself in your shop in short order. WRITE FOR BULLETIN 322-0, for full details.



BUFFALO FORGE COMPANY

174 Mortimer St. Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

School, Yale University (1887). He entered railroad service as a special apprentice in the test department of the Chicago, Burlington & Quincy at Aurora, Ill., in 1887 and later became assistant enginehouse foreman. From 1890 until 1905 he was assistant mechanical engineer and chief engineer of the New York Air Brake Company at Watertown, N. Y. In the latter year he became resident engineer of the Westinghouse Air Brake Company at Wilmerding, Pa., and in 1910, engineer of tests for the American Brake Shoe Company. In 1917 Mr. August was appointed director of inspection for the Westinghouse Electric & Manufacturing Co. at Philadel-



R. C. Augur

phia, Pa., and in 1919 installation engineer, propelling machinery for the Federal Shipbuilding Company. He became managing editor of the Locomotive Car Builders' Cyclopedia in 1920 and consulting editor in 1948.

◆

JOHNS-MANVILLE CORPORATION.—Leslie *M. Cassidy*, formerly president of the Johns-Manville Corporation, has been elected chairman of the board and chief executive officer to replace *Lewis H. Brown*, deceased. *Adrain R. Fisher*, formerly vice-president in charge of all asbestos mining, has been elected president, succeeding Mr. Cassidy.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—The following have been elected vice-presidents of the Westinghouse Electric Corporation: *Tomlinson Fort*, manager of apparatus sales department at Pittsburgh, Pa.; *L. W. McLeod*, southwestern district manager at St. Louis, Mo.; *Emery W. Loomis*, middle Atlantic district manager at Philadelphia, Pa., and *L. E. Lynde*, New England district manager at Boston, Mass., who will now head the company's Washington, D. C., government office. *L. D. Rigdon*, manager of the Headquarters Manufacturing division, has been appointed assistant to vice-president in charge of manufacturing. *C. G. Wallis*, director of Headquarters Manufacturing Engineering department, succeeds Mr. Rigdon as manager of the Headquarters Manufacturing division. *Robin S. Kersh*,


for
extra-protection of your
"extra-fare" freight... SCULLIN
LATERAL VERTICAL
50
CUSHIONED MOTION
TRUCKS
the smoothest
traffic-builder
between
LCL
and your
rails
SCULLIN L-V 50 TRUCK
STEEL CASTINGS MANUFACTURER
NEW YORK
CHICAGO
CLEVELAND
BALTIMORE
RICHMOND, VA.
SCULLIN STEEL CO.
SAINT LOUIS 10, MISSOURI

for Cleaning...



CAB INTERIORS
LOCOMOTIVE EXTERIORS
COACH INTERIORS
WASHROOMS AND TOILETS
LINOLEUM AND TILE
PAINTED AND VARNISHED
SURFACES OF ALL KINDS

With Lowered Material and Labor Costs!

Use the solvent soap that dissolves, emulsifies and disperses the most stubborn of road dirts and every kind of greasy, oily soil that has to be removed from painted or varnished surfaces in railroad cleaning operations . . .

MAGNUS 5-RR

It works fast. In fact, when it is used in spraying operations, all you have to do is spray the solution on and rinse it off to get shiny, absolutely clean surfaces. In hand work of any kind, the rinsing off operation provides whatever scrubbing is necessary for virtually any kind of dirt.

Magnus 5-RR is safe for all good paints and varnishes . . . is easy on the hands . . . and you get active, effective cleaning solutions with as little as a teaspoonful per gallon of water!

Magnus 5-RR not only penetrates and disperses dirt rapidly, but leaves the surfaces you use it on deodorized and disinfected.

Try it—and you'll buy it! Ask for details on the Magnus 30-day free trial offer to railroads on Magnus 5-RR.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

MAGNUS CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

formerly manager of central station sales, has been appointed manager of the company's Steam division at South Philadelphia, Pa.

◆

JOURNAL BOX SERVICING CORPORATION.—*James E. McNamara* has been appointed vice-president of the Journal Box Servicing Corporation, Indianapolis, Ind. Mr. McNamara recently resigned as vice-president of reclamation for Peerless Equipment Company. *Thomas W. Potter*, formerly special representative for the Journal Box Servicing Corporation, has become vice-president—operation. Mr. Potter will maintain his offices jointly with Mr. McNamara at 332 South Michigan avenue, Chicago.

◆

AEROQUIP CORPORATION.—The Aeroquip Corporation of Jackson, Mich., has purchased all the outstanding stock of *Metalco, Inc.*, also of Jackson. Metalco has been a substantial subcontractor of Aeroquip, furnishing a variety of special hose fittings, tube bends, and elbows used in Aeroquip hose assemblies. Operation of the newly acquired company will be continued as a wholly owned subsidiary of Aeroquip, with *Don Mortlock* as vice-president and general manager. *Kenneth Meyerholtz*, chief production engineer and plant superintendent of Aeroquip, has been elected president of Metalco.

◆

BALDWIN-LIMA-HAMILTON CORPORATION.—The office of the Baldwin-Lima-Hamilton Corporation at 120 Broadway, New York 5, has been discontinued and all sales activities in the New York area are now coordinated in the company's offices at 60 East 42nd street, New York 17.

◆

PYLE-NATIONAL COMPANY.—*Charles H. Hobbs* has been appointed a district manager of the Pyle-National Company, with headquarters in St. Louis, Mo. Mr. Hobbs will handle both railroad and industrial business for the company in Misouri, Kansas, Arkansas, southern Illinois and southern Indiana.

Pyle-National has completed construction of two new additions and building changes to its main manufacturing plant in Chicago. The new additions total 28,000 sq. ft. of floor space and will substantially increase manufacturing, maintenance and warehousing operations of the company.

◆

AMERICAN OPTICAL COMPANY.—*John T. Monahan* has been appointed assistant sales manager of the Safety Products division of the American Optical Company, Southbridge, Mass.

◆

PEERLESS EQUIPMENT COMPANY.—*William E. Gray*, first vice-president of the Peerless Equipment Company, a subsidiary of Poor & Co., has been elected president, succeeeding the late David W. Lamoreaux, deceased.

Mr. Gray received his primary and high school education at Pittsburgt, Pa., and is a graduate of Purdue University in mechanical engineering (1923). After graduation he taught mechanical engineer-

DUCTILE IRON

A Revolutionary Metallurgical Development

DUCTILE IRON is a cast ferrous product which combines the *process advantages* of cast iron with many of the *product advantages* of cast steel.

No longer in the pilot-plant stage, this new material is now produced and sold on the basis of specifications. Not only are its individual properties exceptional, but no other common engineering material provides such a combination of excellent castability and fluidity, with high strength, toughness, wear resistance, and machinability.

Actually, "ductile iron" denotes not a *single* product, but rather a family of ferrous materials characterized by graphite in the form of spheroids . . . a form controlled, in a broad sense, by small amounts of magnesium. Presence of spheroidal rather than flake graphite gives this new product a ductility that is unique among gray cast irons.

Four important types of ductile iron now being produced commercially are tabulated below.

REPRESENTATIVE MECHANICAL PROPERTIES OF COMMERCIAL HEATS OF DUCTILE IRON

	Grade	Tensile strength, psi	Yield strength, psi	Elongation per cent	BHN	Usual condition
A	90-65-02	95/105000	70/75000	2.5/5.5	225/265	As-cast
B	80-60-05	85/95000	65/70000	5.5/10.0	195/225	As-cast
C	60-45-15	65/75000	50/60000	17.0/23.0	140/180	Annealed
D	80-60-00	85/95000	65/75000	1.0/3.0	230/290	As-cast

A Pearlitic in structure. Provides good mechanical wear resistance.

B Pearlitic-ferritic in structure. Provides strength and toughness combined.

C A fully ferritic structure usually obtained by short anneal of either (A) or (B). Provides optimum machinability and maximum toughness.

D Higher phosphorous content than preceding grades, also higher manganese. Provides high strength and stiffness, but only moderate impact strength.

SOME UNIQUE PROPERTIES OF DUCTILE IRON

1. Its elastic modulus, about 25,000,000 psi, is virtually unaffected by composition or thickness . . .

2. It can provide a chilled, carbidic, abrasion-resistant surface supported by a tough ductile core. No other single material can combine these properties . . . its only counterpart being a tough material coated with a hard welded overlay.

3. As-cast ductile iron of 93,000 psi tensile strength has the same machinability rating as gray iron with a strength of 45,000 psi.

4. Annealed ductile iron can be machined at a rate 2 to 3 times that of good quality gray iron.

5. It can be satisfactorily welded.

APPLICATIONS

Automotive, agricultural implement, railroad and allied industries apply ductile iron, as-cast and heat treated, in components too numerous to detail.

Machinery, machine tools, crankshafts, pumps, compressors, valves and heavy industrial equipment such as rolls and rolling mill housings, utilize its high strength and rigidity.

In scores of engine, furnace and other parts serving at elevated temperatures, it provides oxidation and growth resistance heretofore unavailable in high carbon castings.

Other applications include paper, textile and electrical machinery, marine equipment, and pipe.

AVAILABILITY

Send us details of your prospective uses, so that we may offer a list of sources from some 100 authorized foundries now producing ductile cast iron under patent licenses. Request a list of available publications on ductile iron . . . mail the coupon now.

EMBLEM OF INCO SERVICE

The International Nickel Company, Inc.
Dept. RMEE, 67 Wall Street
New York 5, N. Y.

Please send me a list of publications on:

DUCTILE IRON

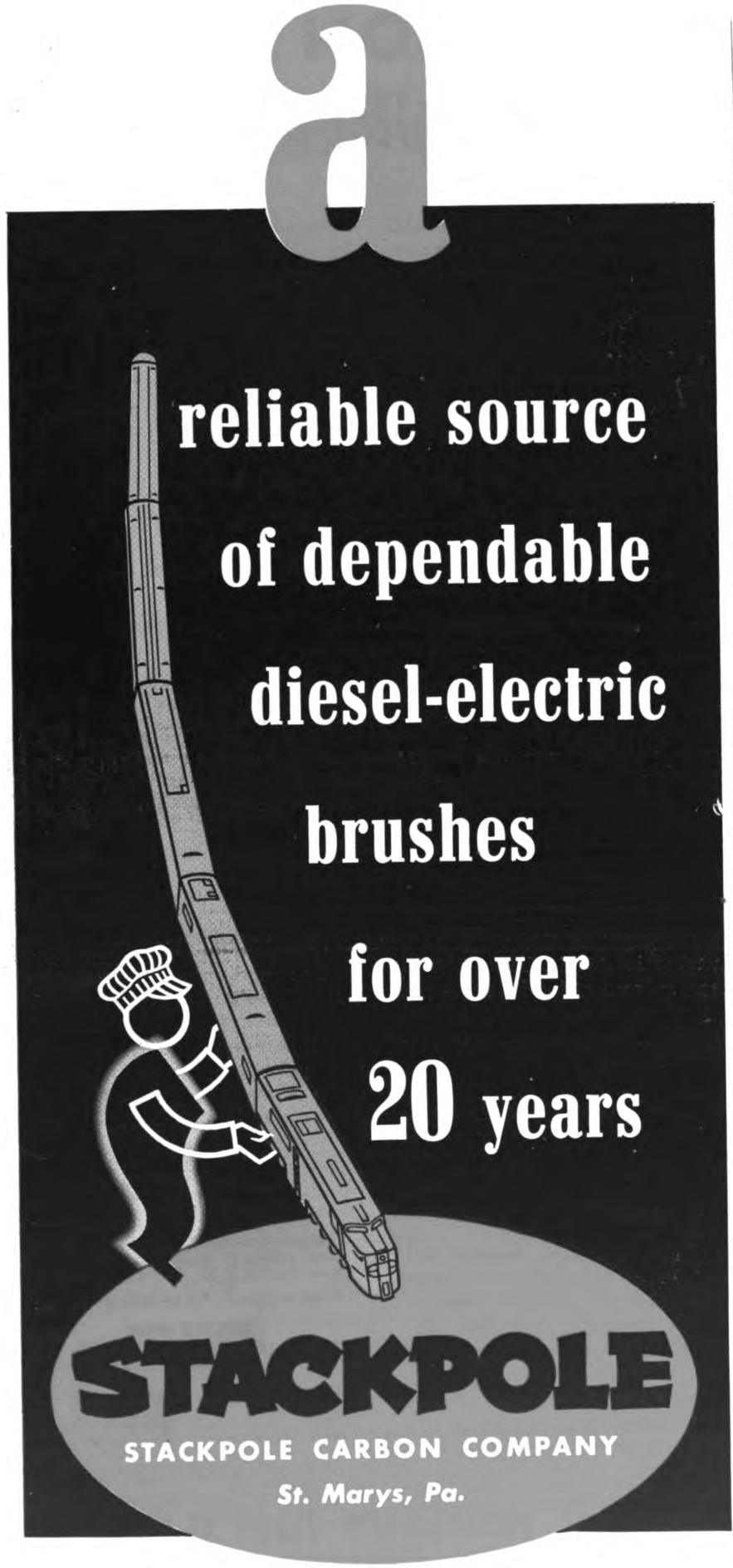
Name _____ Title _____

Company _____

Address _____

City _____ State _____

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5. N.Y.



ing for two years, and subsequently was placed in charge of the Draft Gear Testing Laboratory set up at Purdue by the Association of American Railroads in 1926.



William E. Gray

He remained in charge of the laboratory until October 1943, when he entered the employ of Peerless Equipment as vice-president in charge of engineering. In January 1950, he became first vice-president.

◆

RYDIN RAILWAY EQUIPMENT COMPANY.—*Carl N. Rydin,* formerly with the Chicago, Burlington & Quincy engineering department as engineer and inspector, has resigned to become president of his own



Carl N. Rydin

company, the Rydin Railway Equipment Company, with offices at the Railway Exchange, Chicago. The company will handle a line of car couplers, including a special all-purpose coupler for motor cars and trailers.

◆

AMERICAN HOIST & DERRICK CO.—*John E. Carroll,* general sales manager of the American Hoist & Derrick Co., has been elected vice-president of sales.

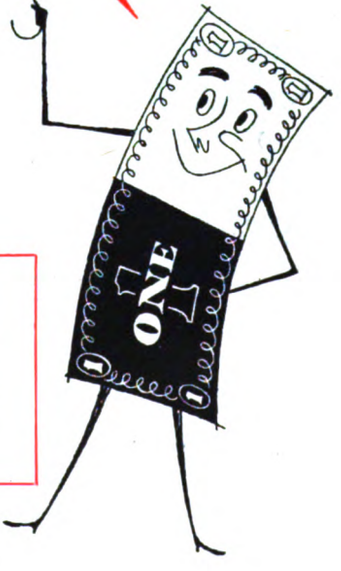
Mr. Carroll, a graduate of the University of Minnesota in 1937, joined American Hoist as a district representative, working successively in the Texas, Chicago and west coast territories. He resigned his sales position in 1945 to become a partner in

OK . . . so I'm a 50-cent dollar





but I can buy more in a Chilled Car Wheel than ever before in history



I'm a 50-cent dollar but, when I'm used right, I can give you a 150-cent value.

Take AMCCW chilled car wheels. My predecessor, the 100-cent dollar, used to make out pretty well with these wheels. In 1929, for instance, the AMCCW wheel averaged about 40-million car miles without failure.

But the AMCCW wheels in service during the last five years of the 1940's, after I'd been devalued, gave you 111-million car miles average per wheel failure, according to ICC reports. The figure for 1950 was close to 120-million. See what I mean about that 150-cent value?

The 50-cent dollar has a point there, thanks to the continuous improvement of the AMCCW wheel. Better foundry methods, stricter inspection, association research—all have helped to step up chilled wheel safety and performance, while loads and speeds were being increased.

Increase in Safety Performance for AMCCW wheels (car miles without failure)	
1950	120,000,000
1929	40,000,000
	80,000,000
or 200% increase	

Now the heavier rim of the redesigned AMCCW wheel doubles rim strength, further increases flange strength. Thicker, heavier brackets (and more of them) give added flange support. (The new wheel is illustrated above.)

So here's the story in a nut-shell:

Although the dollar has been devalued more than 50 per cent, the safety performance of the AMCCW *wheel has increased 200 per cent!*

For more complete information about the advantages of AMCCW chilled car wheels, send for the booklet, "GENTLEMEN OF THE JURY."

Low first cost
Low exchange rates
Reduced inventory
Short haul delivery
Increased ton mileage
High safety standards
Complete AMCCW inspection
Easier shop handling

AMCCW

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 North Sacramento Boulevard, Chicago 12, Ill.

American Car & Foundry Co. • Southern Wheel (American Brake Shoe Co.)
Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co.

Now Available

NEW CLASS H* MOTORS PROTECTED BY DOW CORNING SILICONES

. . . the insulation that has already saved industry millions of maintenance dollars plus the hourly output of hundreds of thousands of men!

This most timely announcement caps the test program we started 8 years ago when silicone resins were introduced by Dow Corning Corporation. First we proved by accelerated life testing that silicone insulated motors had a good 10 to 1 advantage in life expectancy and wet insulation resistance. Then we sold silicone (Class H) insulation to the manufacturers of electrical equipment ranging from lift truck and traction motors to solenoid and brake coils. We also encouraged the better rewind shops to rebuild hard working industrial motors with Class H insulation.

Now we can proudly refer American industry to this goodly list of electrical manufacturers, all able and willing to supply electric machines protected by Class H insulation made with Dow Corning Silicones.

Take your special problems to the application engineer representing any of these companies or to our Product Development Engineers.

furnished by:

ALLIS-CHALMERS MANUFACTURING COMPANY
The Leland Electric Co
Continental Electric Co., Inc.
THE LOUIS ALLIS CO.
ELECTRO DYNAMIC
The Reliance Electric & Engineering Company
ELLIOTT COMPANY
THE B-A-WESCHE ELECTRIC COMPANY
KURZ & ROOT COMPANY
WESTINGHOUSE ELECTRIC CORPORATION
THE MASTER ELECTRIC COMPANY

* "Class H" insulation is the kind of insulation that keeps motors running in spite of "Hell and High water." (slanguage dictionary)

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
DOW CORNING SILICONES

Atlanta • Chicago • Cleveland • Dallas • Los Angeles • New York • Washington, D. C.
In Canada: Fiberglas Canada Ltd., Toronto • In Great Britain: Midland Silicones, Ltd.

the Harron, Rickard & McCone Co. of southern California. Mr. Carroll rejoined American Hoist as general sales manager in 1949.

◆

NATHAN MANUFACTURING COMPANY.—*Wilbur C. Rice*, consulting engineer for the Nathan Manufacturing Company, New York, has been named vice-president in charge of manufacturing.

◆

AMERICAN LUMBER & TREATING CO.—*Edward B. Wilber*, formerly district sales manager for the Aluminum Company of America, has been elected president of the American Lumber & Treating Co., Chicago, succeeding *J. F. Linthicum*, who has retired. Mr. Mr. Linthicum will continue as a director of the firm.

Mr. Wilber began his career with the Aluminum Company as a sales apprentice immediately after he was graduated from Oberlin College in 1920. He worked in sales positions in Oklahoma and Texas until his appointment as manager of the



E. B. Wilber

Washington, D. C., office. In 1943 he was appointed district manager at New York and from 1945 to 1946 worked as a member of the metallurgical division of the U. S. Group Civilian Control Council in Germany.

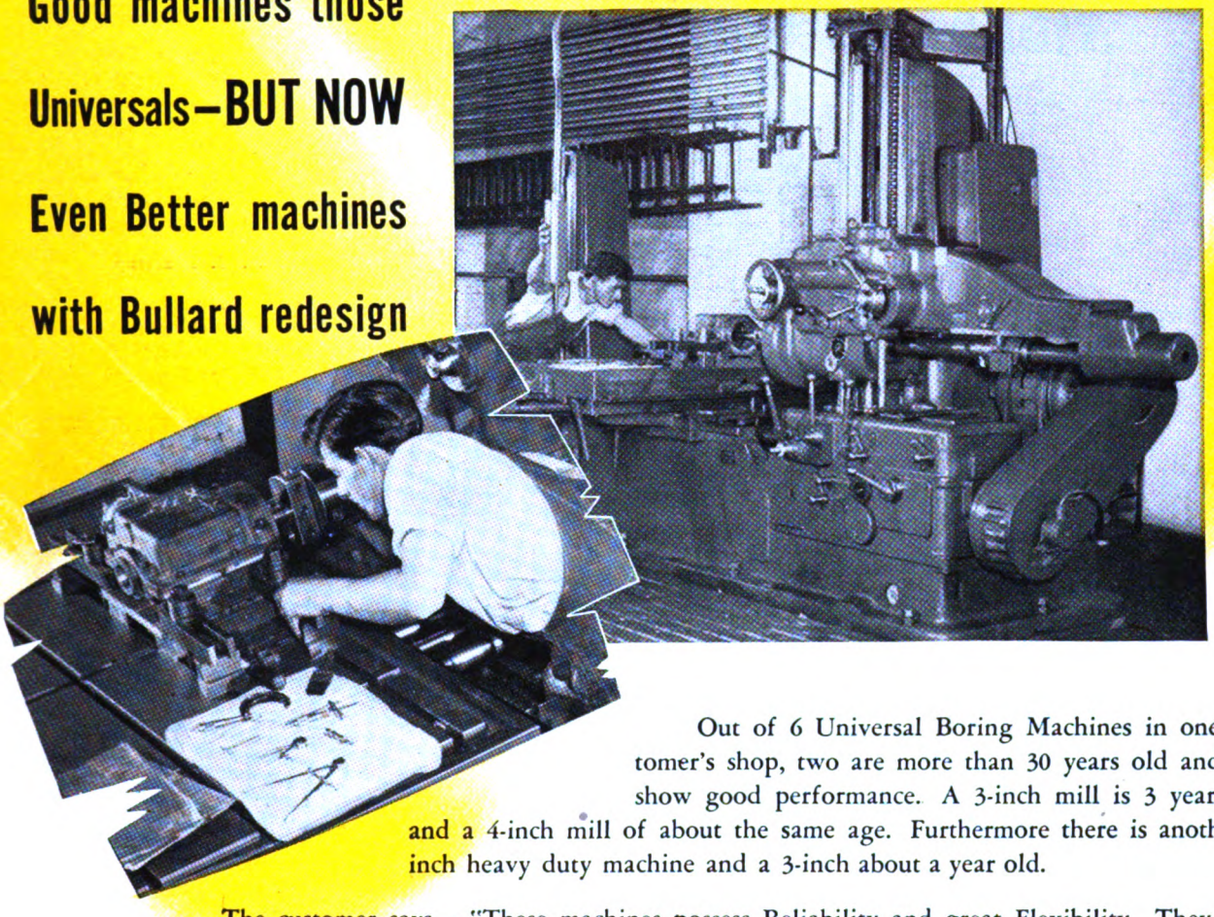
◆

BAKER-RAULANG COMPANY.—The Baker Industrial Truck division of the Baker-Raulang Company has appointed three new sales and service representatives as follows: In the New York metropolitan area and northern New Jersey, the Baker-Raulang N. Y. Corporation and the *Material Handling Equipment Company* have been combined into a new organization—the *Material Handling Equipment Company*—with offices at 141 East 44th street, New York 17. In central and northeastern New York the *Material Handling Company*, 712 State Tower building, Syracuse, N. Y., has been appointed to handle all sales, service and engineering for Baker. The Houston, Tex., branch of the *Dillon Scale & Equipment Co.*, 4014 Navigation boulevard, will represent the company in the area of Texas which borders the Gulf of Mexico.

A New Plus to

Consistent Service

Good machines those Universals—BUT NOW Even Better machines with Bullard redesign



Out of 6 Universal Boring Machines in one customer's shop, two are more than 30 years old and still show good performance. A 3-inch mill is 3 years old and a 4-inch mill of about the same age. Furthermore there is another 4-inch heavy duty machine and a 3-inch about a year old.

The customer says — "These machines possess Reliability and great Flexibility. They meet our requirements because our work is so diversified and yet we require a very accurate machine for back boring, which is a complicated operation done accurately on these machines."

The foregoing bespeaks Consistent Service from the old line of machines. NOW the new heavier design with 4-WAY BED, features providing longer useful life with maintained Accuracy, hydrodynamic main drive with brake motor, Traybon lubrication system for ways and external bearings make Bullard Horizontal Boring, Milling and Drilling Machines an important item for your very earnest consideration.

THE BULLARD COMPANY · BRIDGEPORT 2, CONN.

Ask a **BULLARD** representative to outline the application of a **BULLARD** Horizontal Boring Mill to your work.



Lord Mountings cushion road shock, reduce noise, protect the smooth functioning of equipment, reduce maintenance costs, add to the comfort and satisfaction of the traveling public.

When you plan new locomotives, new passenger cars, new auxiliary equipment be sure that Lord Mountings are in the drawings and the specifications . . . make them a part of design. No other expenditure you can make will bring as great returns from so small an outlay. Here are some of the places where Lord Mountings will serve you profitably:

- **Relay Panelboards**
- **Wheel-driven Generators**
- **Fans**
- **Vestibule Diaphragms**
- **Air Conditioning Units**
- **Power-driven Generators**
- **Signal Equipment**
- **Communication Equipment**

Write for your copy of the Lord Natural Frequency Chart and of the Vibration Isolation Chart. Designers and engineers will find them of definite value.

Although defense production is putting a heavy demand on our facilities, LORD will make every effort to supply industrial needs.

LORD MANUFACTURING COMPANY • ERIE, PA.

Canadian Representative, Railway & Power Engineering Corp. Ltd.

LORD BONDED RUBBER — *Vibration-Control Mountings . . . Bonded-Rubber Parts*

A. M. Byers Company.—*A. B. Drastrup* has been appointed assistant to the president of the A. M. Byers Company, Pittsburgh, Pa., in addition to his position as manager of steel sales, and *Buckley B. Byers*, formerly assistant manager of the New York office and manager of export sales, has been appointed assistant manager of steel sales, at Pittsburgh.



A. B. Drastrup



B. B. Byers

◆

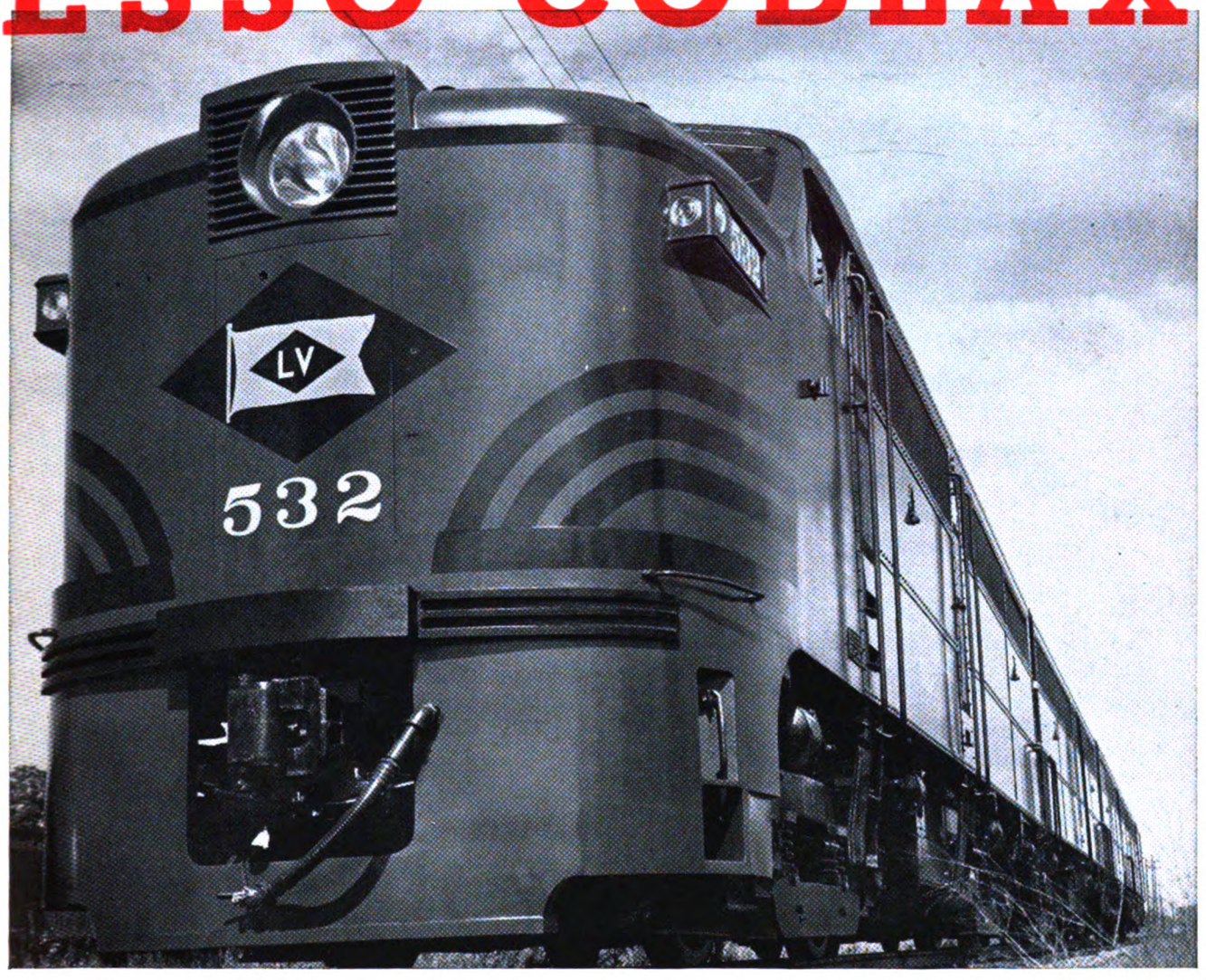
Independent Pneumatic Tool Company.—*Clarence B. Bergren*, service engineer for the Independent Pneumatic Tool Company, in the St. Louis, Mo., territory, has been appointed Cleveland, Ohio branch manager, succeeding *William J. McGraw*. Mr. McGraw has been appointed manager of the New York branch to succeed *Edward W. Krantz*, who has been appointed Pittsburgh, Pa., manager, succeeding *John B. Dempsey*. Mr. Dempsey has been appointed manager of the Detroit, Mich., branch.

◆

Aluminum Company of America.—*Lewis P. Favorite* has been appointed manager of the New York district office of the Aluminum Company of America, succeeding *Edward B. Wilber*.

Mr. Favorite joined Alcoa's Detroit, Mich., sales office in 1927. In 1940 he was transferred to the New York district sales office and in 1944 he returned to Detroit as assistant district sales manager. Mr. Favorite was appointed St. Louis, Mo., district sales manager in 1948 and in October 1950, was appointed product manager of die castings.

ESSO COBLAX



"Tailor-made" to railroad specifications

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

ESSO COBLAX LUBRICANTS

have been specifically developed to provide highly dependable gear lubrication for traction motor drives on electric and diesel-electric locomotives; gas electric and multiple-unit cars; and many other locomotive and car lubrication requirements. Esso COBLAX is availabe in a wide range from fluid oils to semi-solid products... "tailor-made" for railroad applications.

BACKED BY CONSTANT RESEARCH

—keeping pace with latest engine design and developments. Esso Railroad Products are constantly being tested and improved.

BACKED BY CONSTANT FOLLOW-UP

—on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any fuel or lubricating problem.



Plastic tape provides "streamlined" wiring for Modern Streamliners

Modern railroad passenger cars get wiring insulation as compact and streamlined as the cars themselves! Lighting, radio and public address systems safely protected with "SCOTCH" No. 33 Electrical Tape. Shorts, static and other troubles caused by insulation failures have ended. "We specified this tape," said a Superintendent of Communications, "because it provides neat, compact splices where space is at a premium."

Indoors or outdoors, in control panels, signal boxes, switch wiring, etc. "SCOTCH" No. 33 Electrical Tape is a perfect all-weather, all-purpose insulation. It's easy to apply—seals snugly to any surfaces. Makes safe splices in small places. For full information write Dept. RM-451.

• **P. S.**—*for permanent high-heat insulation try* "SCOTCH" *Electrical Tape No. 27 with glass-cloth backing, thermo-setting adhesive.*

Quick Facts about "SCOTCH" No. 33 Electrical Tape

- **TOUGH**—plastic backing is abrasion resistant.
- **HIGH DIELECTRIC**—10,000 volts.
- **THIN CALIPER**—only .007 inch thick.
- **STRETCHY**—conforms to uneven shapes, odd surfaces.



Made in U. S. A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of other "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y.

GENERAL REFRACTORIES COMPANY.—*Jay B. Tracy, Sr.*, has been appointed manager of railroad sales and service of the General Refractories Company, Philadelphia, Pa.

◆

FAIRBANKS, MORSE & CO.—*C. H. Morse, Jr.*, has been appointed manager, locomotive service department, Railroad division, of Fairbanks, Morse & Co. Mr. Morse succeeds *J. E. Justus*, who has retired. Mr. Justus will devote part time to the firm on a special assignment basis, with the title



C. H. Morse, Jr.

of special assistant to manager of the railroad division. Mr. Morse has for the past 18 months served as assistant manager of the locomotive service department, and also more recently as district manager of locomotive sales in the Chicago district. His headquarters will be in the firm's Chicago office, 600 South Michigan avenue.

◆

LORD MANUFACTURING COMPANY.—A. G. *Postlethwait*, president for the past 15 years of the National Bank & Trust Co., Erie, Pa., has been elected vice-president of the Lord Manufacturing Company at Erie, The company has opened a new field office in Dallas, Tex., at 1613 Tower Petroleum building, with *Bruce O. Todd* in charge.

◆

ARCOS CORPORATION.—The Arcos Corporation has opened a west coast office and warehouse at 427 South Western avenue, in Los Angeles, Cal. *B. E. David* has been appointed district manager.

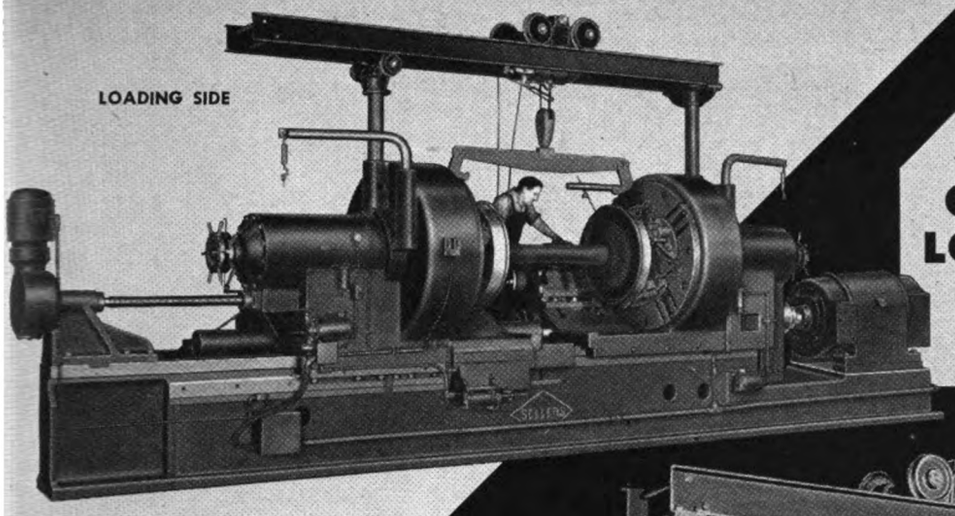
◆

ARMSTRONG CORK COMPANY.—*Howard Stampf, George A. McCormick*, and *Donald L. Davidson* have completed the sales course offered by the Armstrong Cork Company's Industrial Division Sales Training Class and have been assigned, respectively, to the district offices at Cleveland, Ohio, Chicago, and St. Louis, Mo.

◆

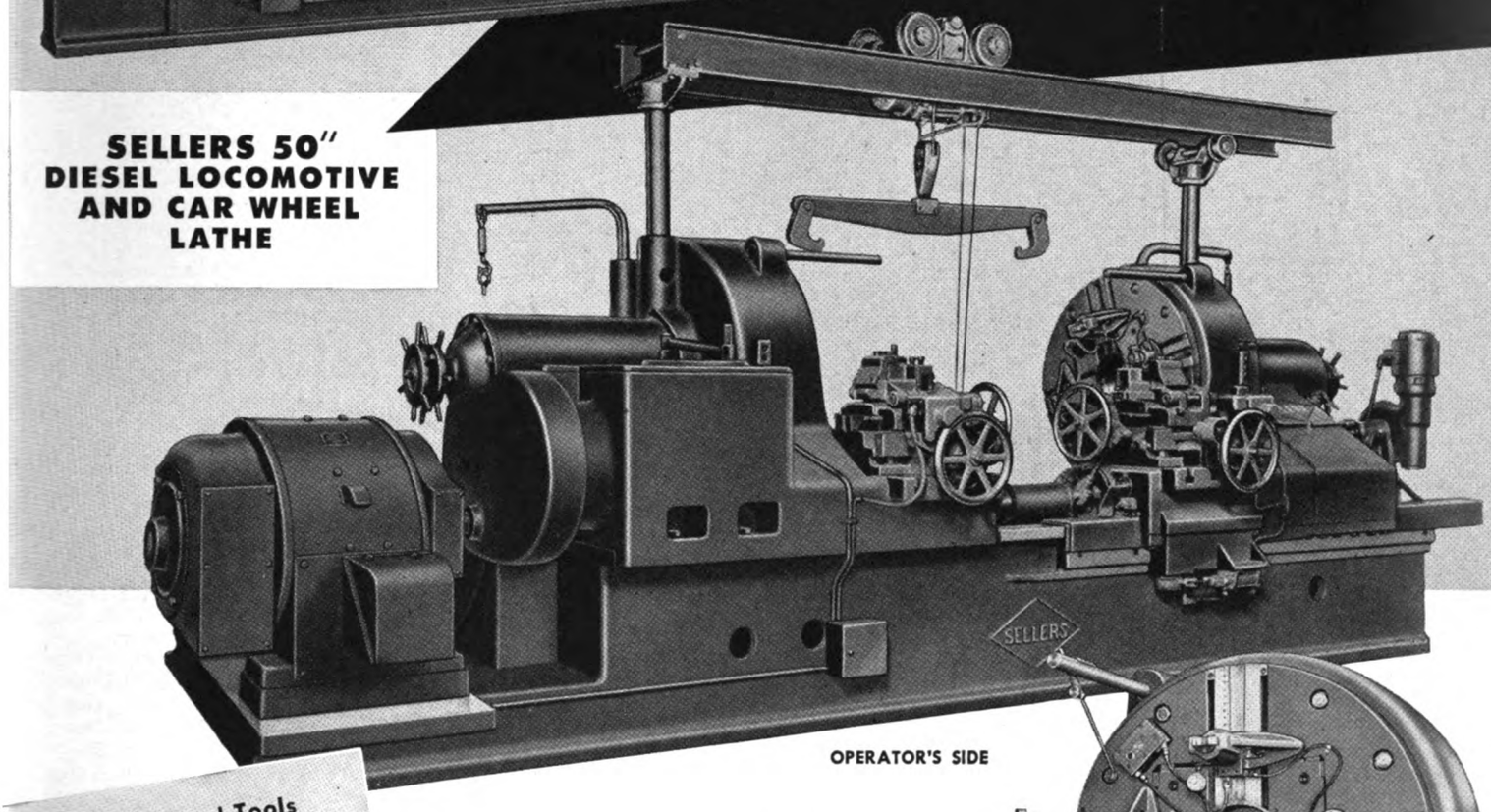
PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*Frank L. Murphy*, formerly chief engineer of the Pullman-Standard Car Manufacturing Company, has joined the company's sales staff at Washington, D. C., as assistant vice-president.

Mr. Murphy began his business career with Pullman-Standard as a draftsman at the passenger-car shops at Chicago in 1922, following graduation from Purdue Univer-



GET GREATER PRODUCTION AT LESS COST IN YOUR DIESEL LOCOMOTIVE AND CAR WHEEL TURNING

SELLERS 50" DIESEL LOCOMOTIVE AND CAR WHEEL LATHE

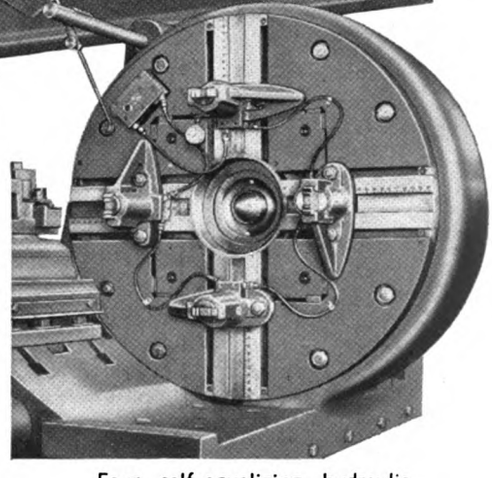


OPERATOR'S SIDE

Among Railroad Tools built by Consolidated are . . .

- CAR WHEEL BORERS
- DIESEL WHEEL BORERS
- BURNISHING LATHES
- TIRE MILLS
- END DRIVE AXLE LATHES
- CENTER DRIVE AXLE LATHES
- JOURNAL TRUING LATHES
- DRIVING WHEEL LATHES
- CAR WHEEL LATHES
- RADIUS LINK GRINDERS
- PROFILE MILLING MACHINES
- SLAB MILLING MACHINES
- ROD MILLING MACHINES
- CYLINDER BORING MACHINES
- KEYWAY MILLING MACHINES
- CRANK PLANERS
- DRILL PRESSES
- AND OTHERS

The Sellers 50" Diesel Locomotive and Car Wheel Lathe turns diesel locomotive and car wheels from 28" to 50" tread diameter. Designed with speed range suitable for either carbide or high speed steel tools. Two mechanical speed changes in conjunction with a variable speed 75 H.P. motor provide speed ranges of approximately .9 to 3.6 R.P.M. and 5 to 20 R.P.M. of face plate, with instantaneous speed selection. Faceplates are recessed, and furnished with removable filler blocks, for turning diesel wheels, motor coach wheels and trailer wheels equipped with roller bearings.



Four self-equalizing hydraulic drivers on each faceplate insure equalized pressure on wheel rims

Complete information covering this modern machine will be furnished upon request. Let us show you how it should help to save you money while increasing your production.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED

MACHINE TOOL CORPORATION

CHEST

STOP RUST





Available in many colors, aluminum and white.

RUST-OLEUM can help you control rust—to cut your maintenance costs—and to avoid needless rust losses. It stops rust effectively—and prolongs the useful life of rustable metal so that costly replacements can be deferred years longer than previously could be expected.

Railroads find RUST-OLEUM the practical answer to many rust problems. Its tough, pliable film gives excellent protection to rolling stock, bridges, tanks, metal buildings, signal equipment and other properties.

CUT YOUR MAINTENANCE COST

Rescue metal that has already started to rust. RUST-OLEUM can be applied *even* over metal already rusted —usually without sandblasting or the use of chemical cleaners. Simply scrape and wire-brush to remove rust scale and loose rust. Then apply RUST-OLEUM by brush, dip, or spray. It stops the rust, and promptly dries to a firm, pliable, rust resistant protective coating.



Write for your copy of the RUST-OLEUM Railroad Catalog



RUST-OLEUM CORPORATION

2590 Oakton Street **EVANSTON, ILLINOIS**



F. L. Murphy

sity's engineering school. In 1935 he was appointed principal engineer directing design and development of lightweight streamline trains. From 1942 until 1950 Mr. Murphy served as chief engineer of the company, directing all engineering, including design, experimental and research work on railroad passenger cars, freight cars and street transit equipment.

◆

BLACK & DECKER MANUFACTURING CO. —Black & Decker has opened a sales and service branch at 881 W. Delavan avenue, Buffalo 9, N. Y. The new building covers over 4,100 sq. ft. The company has also purchased approximately 180 acres of land at Hampstead, Md., where a plant will be built to provide additional facilities for the manufacture of portable electric tools.

◆

VAPOR HEATING CORPORATION. — The Vapor Heating Corporation, Chicago, has announced transfer of the following sales and service personnel: *H. E. Nichols*, from Cleveland, Ohio, to New York; *R. C. Smykal*, from New York to Cleveland; *J. H. Paulding*, from the main plant at Chicago to Harrisburg, Pa.; *J. Murray*, from Harrisburg to Philadelphia; and *M. K. Loomis*, from Philadelphia to the general office at Chicago.

◆

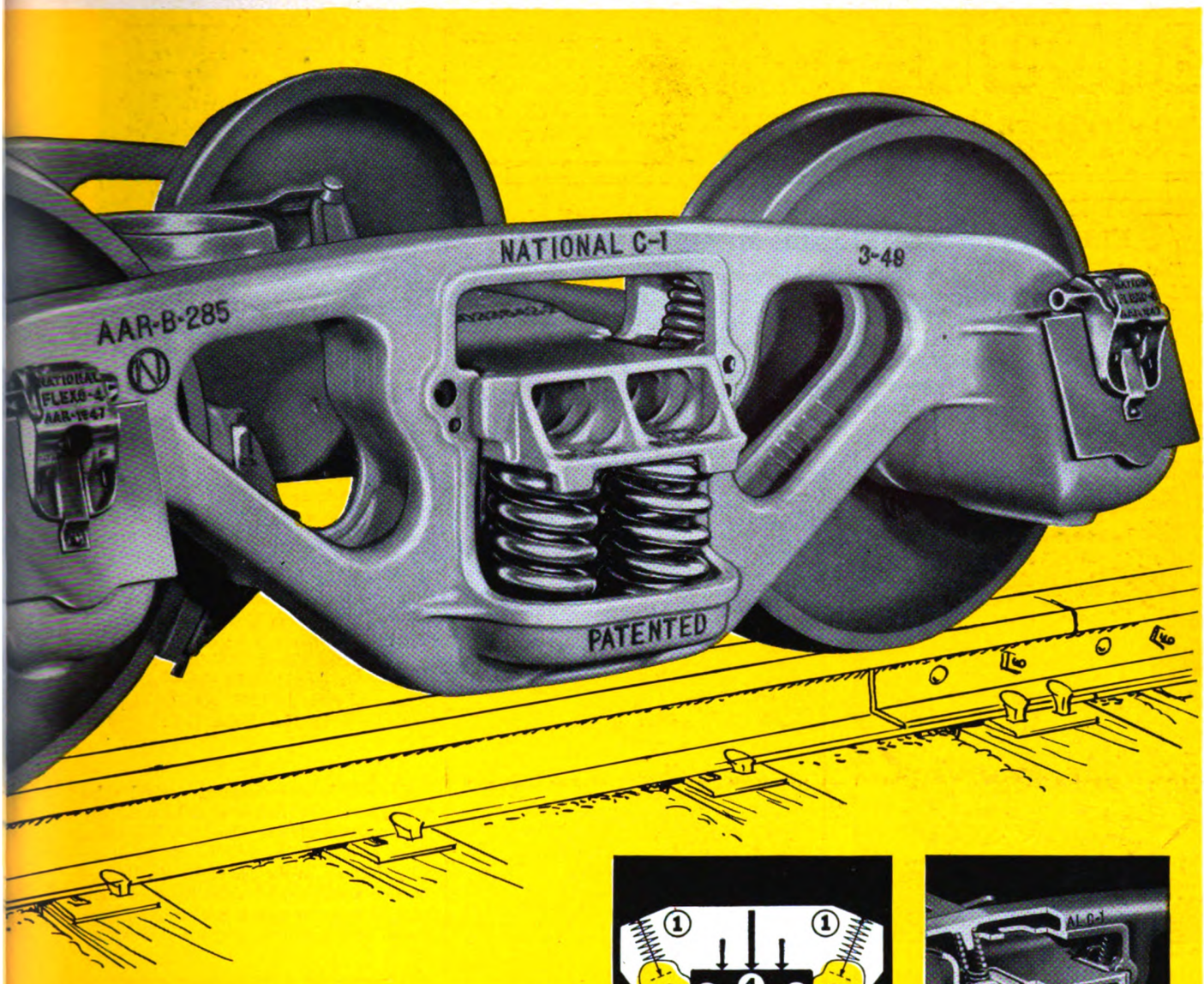
PYRENE MANUFACTURING COMPANY.— *Wallace B. Phillips* has been elected president of the Pyrene Manufacturing Company, Newark, N. J., succeeding Edward J. Waring, who retired in August 1950.

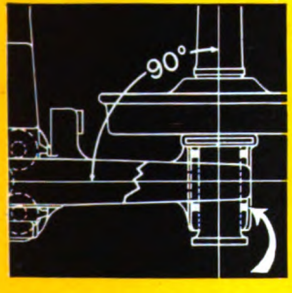
Obituary

EDWARD LOUIS HOLLJES, general sales manager of the William Sellers Company division, Consolidated Machine Tool Corporation, died on February 3. He was 66 years old.

◆

ERNEST MURPHY, former president of the Pressed Steel Car Company, died on March 4 at his home in Wilton, Conn. Mr. Murphy was 67 years old. He was born in Padiham, England, and received his early education and training in that country. He came to the United States in 1909 and in the same year became division engineer of the Butler, Pittsburgh, Harmony & New Castle Interurban Traction Co. In 1911 he joined

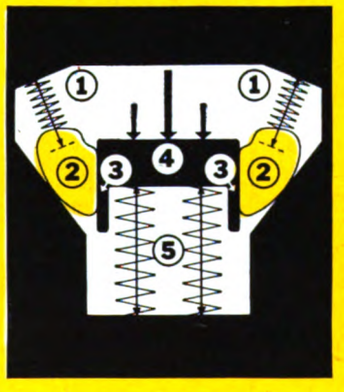


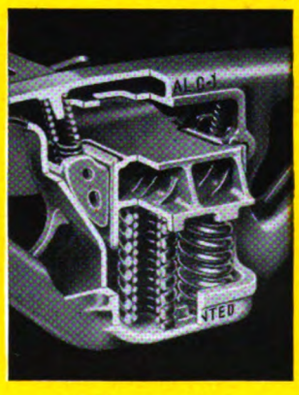




5 JOURNAL BEARING LUG PROTECTION. Four journal bearing wedge aligning lugs in each journal box limit truck unsquaring, preventing breakage of journal bearing lugs.

6 FULL BOX-SECTION BOLSTER . . . Friction mechanism in side frame controls both lateral and vertical motion . . . permits full box-section bolster of maximum torsion and bending resistance.





INSIDE STORY OF A "LADING-CONSCIOUS" RIDE. Constant pressure of wedge springs (1) forces friction wedge (2) down side frame against bolster wear plates (3), providing friction to control the vertical and lateral oscillations of the supporting springs. Car floats on full box-section bolster (4) & standard spring groups (5).

The National Malleable and Steel Castings Company, Cleveland 6, Ohio

NATIONAL CASTINGS COMPANY

JOURNAL BOXES AND LIDS

NATIONAL *Products*
FOR TRANSPORTATION AND INDUSTRY
Est. 1868

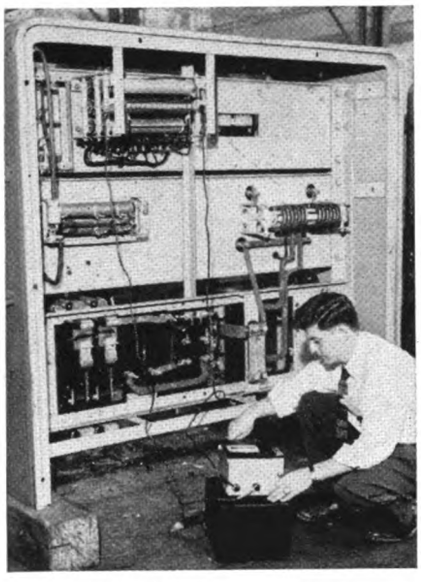
BIDDLE

NUMBER 4 OF A SERIES

Instrument News

BRIDGE-MEG . . . a complete and convenient instrument for ELECTRICAL RESISTANCE MEASUREMENTS

Photo shows an electrical engineer at Baldwin Locomotive Works making a Wheatstone bridge test on the auxiliary generator in a control chassis for a 1000-hp diesel-electric engine. In railroad shops, the Bridge-Meg is a time-saving investment for checking power and control circuits in diesel-electric engines, for checking air conditioning and communication circuits on passenger coaches, and for resistance tests on installed power and lighting equipment.



In one portable unit, railway electrical men enjoy the convenience of a Megger Insulation Resistance Tester, a Wheatstone bridge for measuring coils, resistors and circuits, and an optional feature—the Varley Loop connection—for locating faults on wires. The Bridge-Meg weighs only 15 lbs. Test current is supplied by a hand-cranked generator. There is no dependence on batteries or outside source of current. A rotary switch permits instant selection between insulation resistance and Wheatstone bridge functions.

Conductor resistance range of the bridge is .01 ohm to 999,990 ohms. Insulation resistance ranges from 10,000 ohms to as high as 1000 megohms. Set is available in various ratings, 250, 500, or 1000 volts d-c.

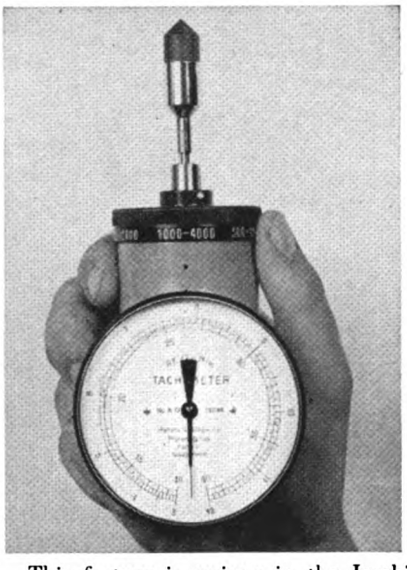
Every railroad electrical engineer should be familiar with this instrument. Bulletin 21-60-X contains 12 pages of description, illustrations and charts. Your request will bring you a copy by return mail.

REDUCE COST OF TACHOMETER REPAIRS

—Keep Them on the Job Longer

The new Jagabi® single, and multi-range tachometers remain on the job longer and cut repair costs in half because they now include overspeed protection.

Incorporated in these latest instruments is a clutch device which *minimizes* the harmful effects of overspeeding and too-sudden acceleration.



This feature is unique in the Jagabi Tachometers and worth many times the very small initial cost. Longer instrument life and far fewer repair bills mean reduced expenses for you. One, three and five-range instruments are available in a variety of ranges from 25 RPM to 48,000 RPM.

Write today for Bulletin 35-X for complete information including prices.

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up-to-date.

JAMES G. BIDDLE CO., 1316 ARCH ST.

PHILADELPHIA 7, PA.

ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT



Ernest Murphy

the Interborough Rapid Transit Company at New York, and from 1917 to 1940 was associated with the United Traction Company at Albany, N. Y. At the same time, he was also president of the Capital District Transportation Company in Albany. Mr. Murphy became associated with Pressed Steel Car in March 1951, at its Hegewisch plant, Chicago, where he was in charge of the Armored Tank division. He later became vice-president in charge of operations, and early in 1945 was elected president. He retired in March, 1948.

◆

EDWARD JOSEPH HELLINE, general sales manager of the Reliance division of the Eaton Manufacturing Company, Massillon, Ohio, died on February 8 in the Massillon City Hospital, at the age of 48. Mr. Helline became associated with the Reliance Division 32 years ago as a mail clerk. Before assuming the position of general sales manager, he had advanced through the advertising and sales departments. Subsequently he served as manager of the order and billing department, manager of the service department, assistant to the general sales manager and assistant to the general manager, and was in charge of snap ring sales, engineering and production. He became general sales manager in June, 1947. Mr. Helline was chairman of the standards committee of the Spring Washer Institute.



E. J. Helline

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oil R.R.

UNIT Alco Diesel—6 cyl. 12½" x 13"—1000 H.P.

SERVICE Mountain haul—Heavy snow, extreme cold

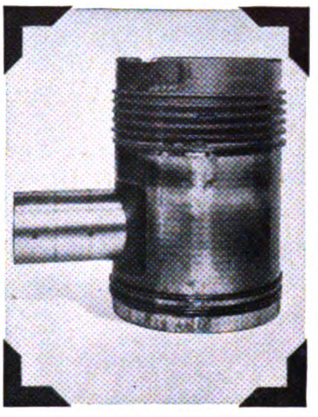
LOCATION Spokane, Wash.—Yahk, B.C.

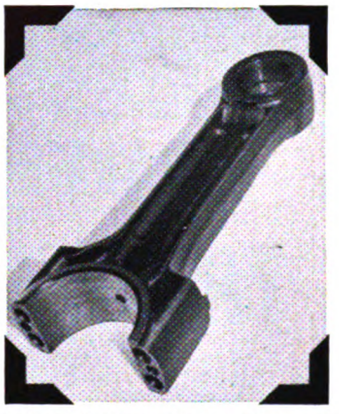
FIRM Spokane International R.R. Co.

Engines in "perfect condition" after year of toughest service!

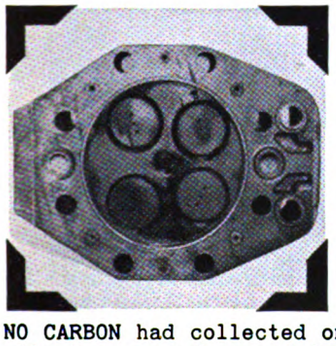


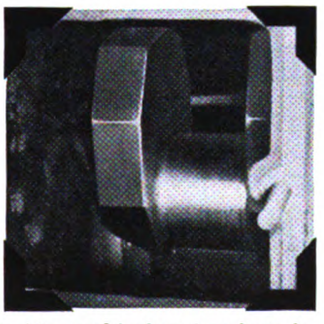
LUBRICATED WITH RPM DELO Oil R.R., nine new diesels owned by the Spokane International R.R. Company were kept in regular service for one year. The winter was exceptionally severe and the locomotives bucked heavy snow almost daily. They worked or were idled in temperatures that often for periods of ten days averaged from 20 to 40 degrees below zero.





On inspection at the end of that time there were no accumulations of sludge in oil systems and the engines were in "perfect condition" as pictures of parts from one of them indicate.



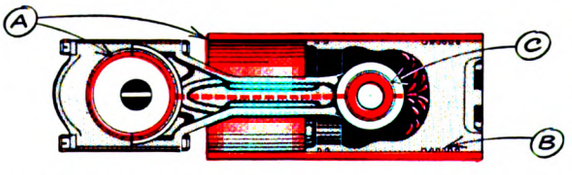


NO CARBON had collected on the cylinder head and all rings were free and functioning properly. Connecting-rod and main bearings and wristpin were within standard tolerance. Measurement of the liner showed less than 0.001 inch wear.

REMARKS: The Spokane International Railroad provides an important connecting service between transcontinental lines through Spokane and the Canadian Pacific to the north. Most of their trackage is in northern Idaho where severe weather and other conditions often make operation difficult. RPM DELO Oil R.R. will meet the toughest weather or operational conditions in all locomotive diesel engines.

RPM DELO LUBRICATING OILS

How RPM DELO Oil R.R. prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities . . . keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer . . . prevents ring-sticking. Detergent keeps parts clean . . . helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of bushing or bearing metals and foaming in crankcase.

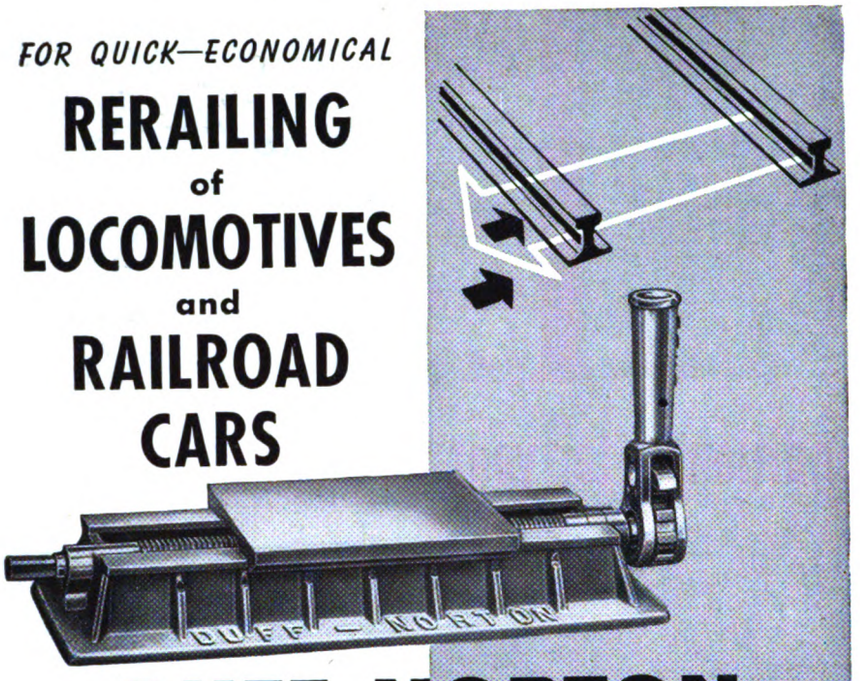
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco — STANDARD OIL COMPANY OF TEXAS, El Paso, Texas
THE CALIFORNIA OIL COMPANY, Barber, N.J. & Chicago, New Orleans — THE CALIFORNIA COMPANY, Denver, Colorado

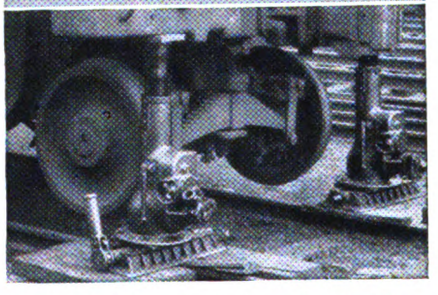
FOR QUICK—ECONOMICAL

RERAILING of LOCOMOTIVES and RAILROAD CARS



DUFF-NORTON *TRAVERSING BASES*

Emergency rerailing of Diesel, steam, electric locomotives and railroad cars . . . is safe, simple and low in cost, with Duff-Norton Traversing Bases. Carried on wreck trains in units of two bases and two jacks, they eliminate the need for expensive cranes and are always available for any rerailing job.



Traversing Bases and Jacks are placed under load. for rerailing locomotives and cars.

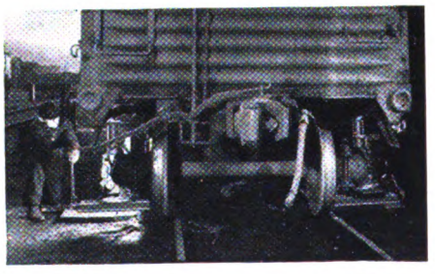
QUICK DATA ON TRAVERSING BASES

Jack No.	Capacity Tons	Height Inches	Horizontal Travel Inches	Weight Pounds	Size of Plate Inches
39-TB	35	3¾	15	85	12 dia.
*40-TB	50	4	15	106	10 x 12
41-TB	50-75	4	20	140	14 dia.

*No. 40-TB can also be furnished for 26" horizontal movement on special order.

No. 40-TB furnished with wooden operating lever 1 1/16" x 24" long.

Nos. 39-TB and 41-TB supplied with steel operating lever 1" x 24" long.



Freight car is lifted and moved horizontally until wheels are aligned with rails. Jacks are lowered to complete rerailing job.

For Jacks Used With Traversing Bases . . . Write for Your Copy of Bulletin AD-4-R.

DUFF-NORTON JACKS — STRENGTH, SAFETY, DURABILITY — ESTABLISHED 1883

THE DUFF-NORTON MANUFACTURING CO.

Main Plant and General Offices, PITTSBURGH 30, PA. Canadian Plant, TORONTO 6, ONT.

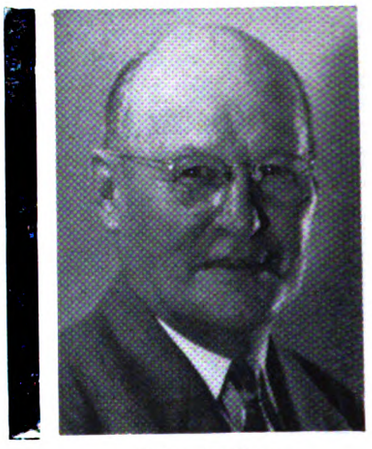
"The House that Jacks Built"

PERSONAL MENTION

General

FRANK BITTNER, superintendent of motive power and car equipment of the Quebec district of the Canadian National at Quebec., Que., has retired. Mr. Bittner was born at Pittsburgh, Pa., and entered railroad service in 1904 as a machinist apprentice. From October 1908 to June 1917 he was machinist at various points with the Quebec, Montreal & Southern (now C.N.), later becoming erecting shop foreman, fitter, locomotive fireman and machine shop foreman. He was appointed assistant foreman of the C.N. in October 1929; night locomotive foreman at Janquiere, Que., in 1930; locomotive and car foreman at Taschereau, Que., in April 1937; lomotive foreman at Limoilou in 1941 and superintendent motive power and car equipment of the Quebec district in August 1943.

FRED WARNER BELLINGER, has been appointed general manager of the Butte, Anaconda & Pacific, at Anaconda, Mont. Mr. Bellinger was born on September 18, 1886, at Cannon Falls, Minn. He entered railroad service in the summer of 1906 as



F. W. Bellinger

an electrician on the Great Northern, and subsequently was traveling electrical foreman and, later, chief electrician in charge of Cascade tunnel electrification. From 1912 to 1913 he was associated with the Consumers Power Company at St. Paul, Minn., and the Northern Mississippi River Development Company at Minneapolis, joining the B. A. & P. in 1913 as electrical superintendent at Anaconda. In 1932 Mr. Bellinger was appointed mechanical and electrical superintendent and in 1943 superintendent, in which capacity he served until his appointment as general manager.

H. S. MCTEER, locomotive foreman of the Canadian National at Limoilou, Que., has been appointed superintendent of motive power and car equipment of the Quebec district at Quebec, Que.

Royalty on the Rails

The Seaboard's "Silver Meteor"

Spicer Generator-Drive Equipped

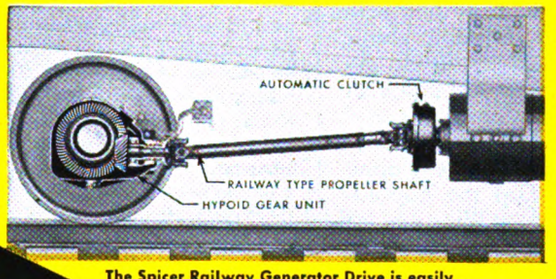
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For instance, if you're traveling with small children, it's reassuring to know that near at hand are the services of a Registered Nurse. Yes, a smartly-uniformed, experienced R. N. is aboard the Diesel-powered Streamliner, always ready to assist you . . . without charge, of course. Passenger Service Agents are also available on these trains to provide travel help and information.

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Niagara Falls is one of North America's most famous scenic landmarks. They are visited every year by over 2,000,000 visitors. Besides the grandeur and beauty of the falls, the hydro-electric horsepower developed here serves half of the population of the state.

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DEVICES, INC.
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MANUFACTURERS OF THE FAMOUS
AIR-PUSH WINDSHIELD WIPERS

Car Department

B. F. Orr, superintendent of the Beech Grove, Ind., car shop of the New York Central, after 45 years with the company.

John A. Brossart, assistant to general superintendent equipment-car of the New York Central system at New York, who has retired as announced in the March issue, was born in Aurora, Ind. He attended high school and in 1903 became a



J. A. Brossart

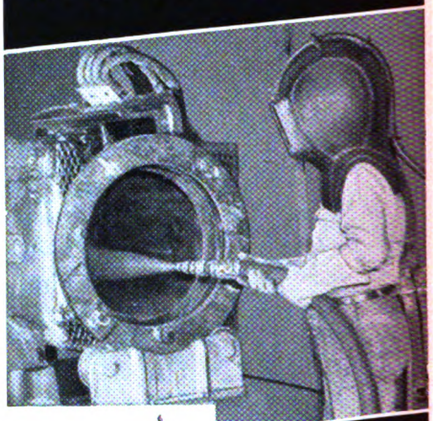
car inspector in the employ of the Cleveland, Cincinnati, Chicago & St. Louis at Brightwood, Ind., serving subsequently as assistant foreman and foreman, respectively, until April 1914, when he was appointed general foreman at the Beech Grove, Ind., car shops. In 1925 he was appointed shop superintendent and in 1927 superintendent rolling stock. In 1934 he became assistant to general superintendent rolling stock of the New York Central system at New York, and on January 1, 1949, assistant to general superintendent equipment-car. Mr. Brossart retired on January 1 of the present year. He is a member of the New York Railroad Club and the New England Railroad Club.

Frank J. Kossuth, who has been appointed assistant to general superintendent equipment—car of the New York Central system, with headquarters at New York,



F. J. Kossuth

CLEAN Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

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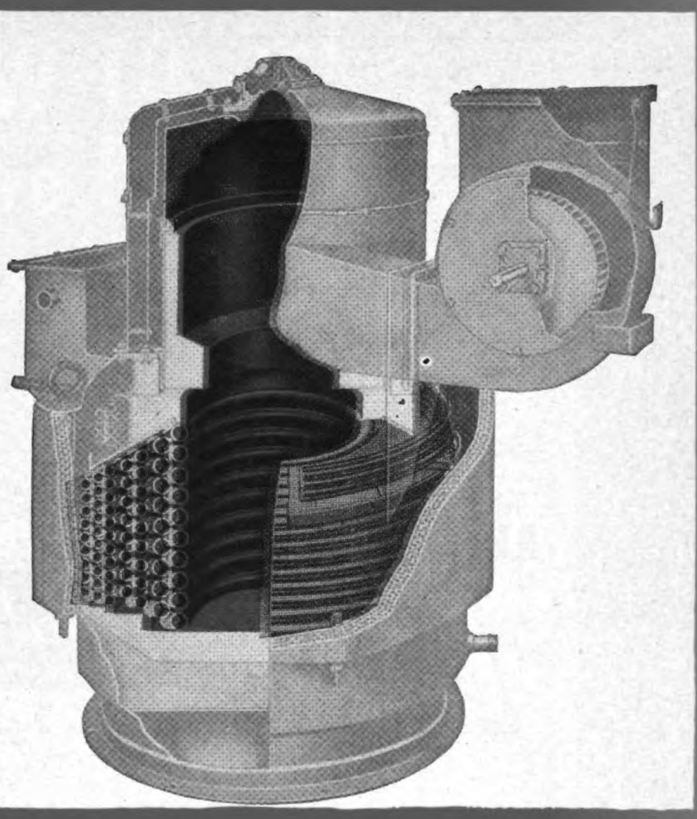
Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

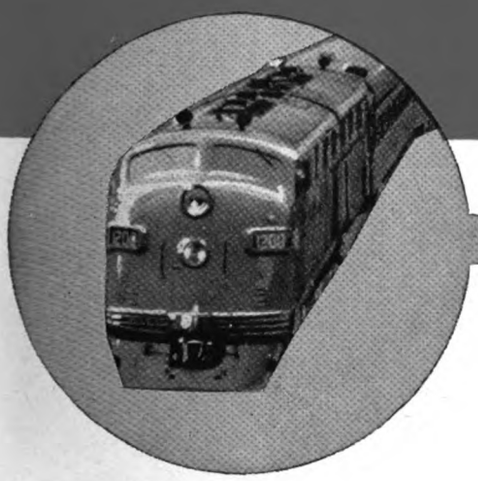
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with the right equipment for every job

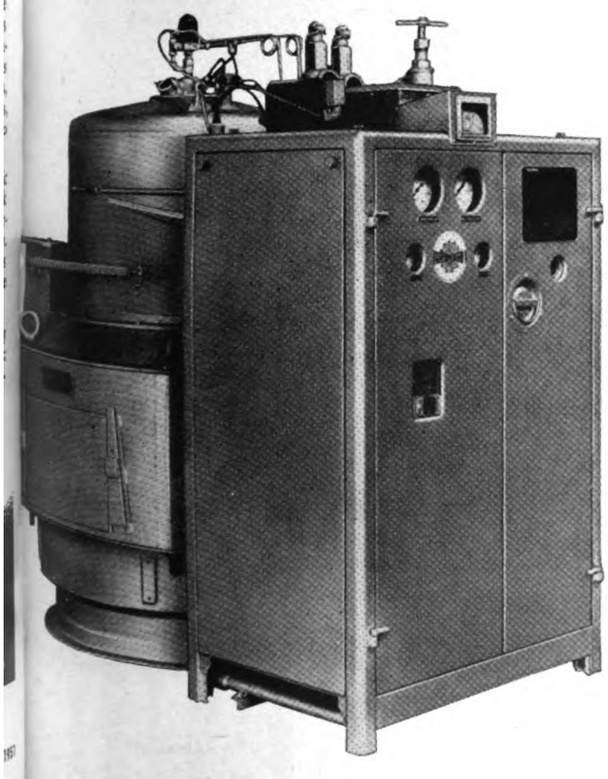
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. . . uses less water per pound of steam delivered at the train line and it delivers this steam at 99.5° of dryness.

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as announced in the March issue, was born at Cleveland, Ohio, on May 24, 1909. He entered the employ of the New York Central at Collinwood, Ohio, as a carman apprentice in 1927. He left in 1941 as fabricating freight foreman at Beech Grove, Ind., to enter military service with the 753rd Railway Shop Battalion. After four years overseas in Africa, Italy, and the Philippines, Mr. Kossuth returned to the New York Central in 1946. He was appointed assistant superintendent of equipment, eastern lines, on August 1, 1948.

C. C. CORNEILS, general foreman, passenger car repairs, of the Chicago, Burlington & Quincy, at Aurora, Ill., has been appointed assistant superintendent of shops at Aurora.

Master Mechanics and Road Foremen

PAUL LUCAS has been appointed assistant master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Milwaukee, Wis.

O. M. HOENSHELL, master mechanic of the Lincoln-Omaha-Wymore divisions of the Chicago, Burlington & Quincy at Lincoln, Neb., has retired after 52 years of service.

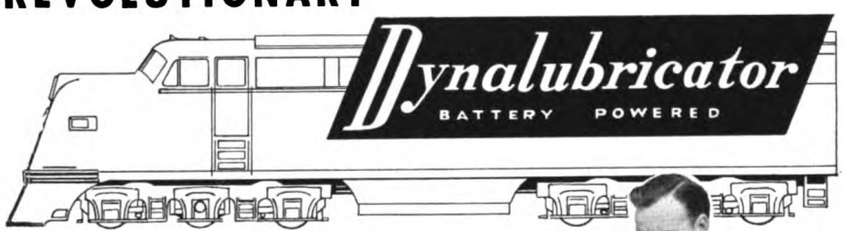
H. F. ROESCH, assistant master mechanic of the Casper-Sheridan divisions of the Chicago, Burlington & Quincy at Sheridan, Wyo., has been appointed master mechanic of the divisions.

J. L. SHAFER, general foreman of the Chicago, Burlington & Quincy at Greybull, Wyo., has been appointed assistant master mechanic at Sheridan, Wyo.

B. F. MELICAN, master mechanic of the Casper-Sheridan divisions of the Chicago, Burlington & Quincy at Casper, Wyo., has been appointed master mechanic of the McCook division with headquarters at McCook, Neb.

C. E. BLOOM, master mechanic of the Chicago, Burlington & Quincy's McCook division at McCook, Neb., has been transferred to the position of master mechanic of the Lincoln-Omaha-Wymore divisions, with headquarters at Lincoln, Neb.

REVOLUTIONARY



PUMPS HEAVIEST GEAR CASE LUBRICANTS

ELIMINATES MESSY HAND-DISPENSING

AUTOMATICALLY PUMPS MEASURED AMOUNTS



With the DYNALUBRICATOR modern shops are now servicing every gear case of a 3-unit locomotive *in just 10 minutes! Exact amounts* of lubricant assured by automatic metering and cut-off device. *No-Drip Nozzle* gives convenient, positive control over grease flow, eliminates messy dripping. Lubricants kept at working temperature automatically. Battery power eliminates trailing wires during operation. Easily handled by one man.

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NEW DEVICES

(Continued from page 90)



construction to give efficient operation and there are no delicate relays, rectifiers, fuses or open arcing contacts.

Improved Spiral Milling Attachment

An improved spiral milling attachment, whose spindle is mounted on anti-friction bearings and spindle nose conforms to the No. 40 standard milling machine is now available from The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. It increases the variety of set-ups which may be handled on the Cincinnati units.

The attachment was designed for the milling of helical and spiral gear teeth. Its double swivel construction makes it

CONSERVATION
MAINTENANCE
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QUAKER'S COMPLETE PLAN FOR LONGER PRODUCTIVE LIFE FROM INDUSTRIAL RUBBER PRODUCTS

Now, to meet the need to produce more with less, put the QUAKER Conservation Maintenance Plan to work in your operations.

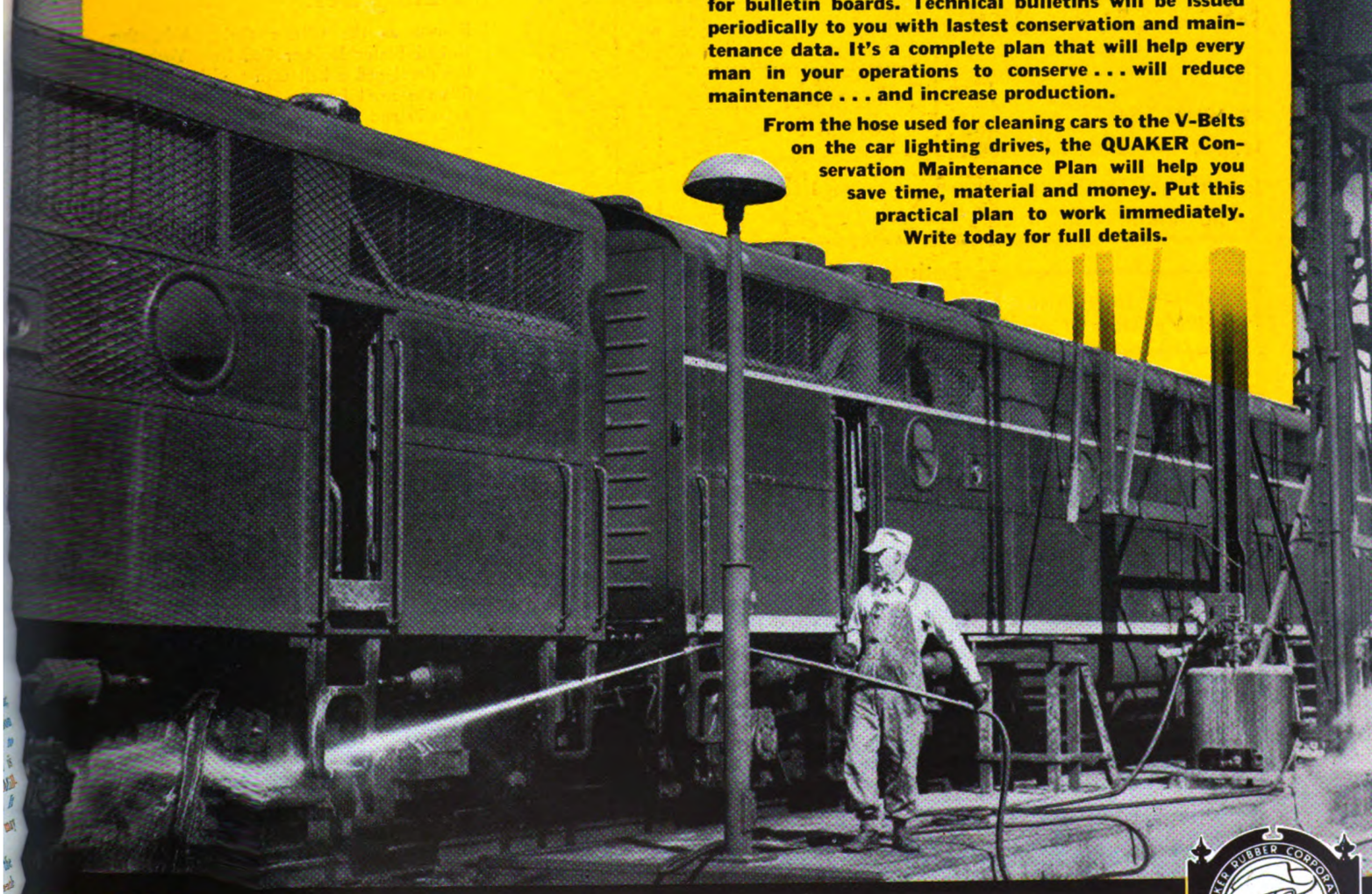
Developed by Quaker Engineers to help you get more production out of your industrial rubber products with less maintenance, this plan is practical and easily applied by any man in your operations.

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From the hose used for cleaning cars to the V-Belts on the car lighting drives, the QUAKER Conservation Maintenance Plan will help you save time, material and money. Put this practical plan to work immediately. Write today for full details.

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suitable for vertical and angular milling in tool and die shops, production and maintenance shops.

On a machine of current design and practically all old designs of Cincinnati plain and universal millers, this improved device eliminates the usual 45 deg. limitations for the swivel range of the table, and extends it to 90 deg. or more.

Large diameter swivel bearings promote rigidity when taking heavy cuts, and hardened alloy steel gears provide ample strength. Rigidity at the outer end of the attachment is obtained by a supporting stud which fits into the angular machine arbor support.

Elevator Increases Welder's Flexibility

When the Great Northern rebuilt 400 ore cars, the Unionmelt flexible welder, a product of The Linde Air Products Co., Unit of Union Carbide & Carbon Corp., New York 17, was used for many operations. Welds were made at high speed in places hard to get at with other automatic welding machines, the flexible hose and nozzle covered an area of 1,000 sq. ft.

By using an air-operated elevator device to raise and lower the rod and melt feed machine, the range for one of the operations on the new car baskets was increased 80 per cent. In the upper position, plug welds were made through rivet holes on re-used side stakes. Lowered, the flexible welder was used to make butt welds between end and side slope sheets.

Goggle Padding Mask

A molded rubber detachable padding mask for Willson heavy duty cover-all safety cup goggles has been announced by Willson Products, Inc., Reading, Pa. The product assures an extra tight fit for better protection in welding, chipping, heavy dust and acid operations.

The padding mask is attached to the goggles by means of a beaded molding which slips over the rims of the eyecups, providing a firm, light-tight joint. It is replaceable, and can be changed without the use of any tools. The soft, molded rubber assures a snug, comfortable fit for all shapes of faces. Also, the mask provides added clearance when goggles are worn over prescription spectacles.

The mask may be purchased as an accessory with Willson cup goggles, or may be bought separately for application to goggles already in use.

Rubber and Fabric Timing Belt

Known as the Gilmer timing belt, the United States Rubber Co., New York 20, has developed a belt with teeth which fulfills the need for a power drive that will not slip and permits split-second precision timing. It will attain speeds up to 16,000 ft. per min. and operate more quietly than precision gears running in an oil bath.

The belt has replaced flat belts, V-belts, chain drives and gears in hundreds of applications. It can also be used as a functional part such as a synchronized conveyor as well as for transmitting power.

This product has been tested in fan belt service by two automotive manufacturers and found to wear two to five times longer

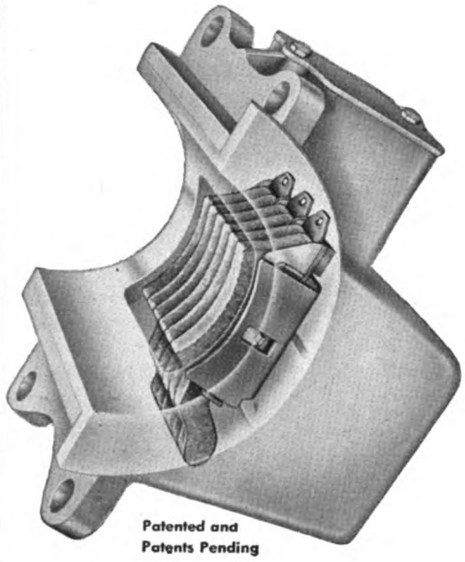




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than V-belts. In automotive camshafts, it has been found to withstand more than 100,000 test miles of service without failure or retiming. On portable chain saws it provides power to take the severe punishment caused by instantaneous stalls.

In appearance, the belt is similar to a flat belt except that it has regularly spaced rubber teeth along its inner surface which engage in corresponding grooves in the pulleys. It can be manufactured in any desired size and in a variety of materials to suit specific applications.

The belt requires no lubrication and oil will not harm it. It is unusually compact and speed ratios up to 30 to 1 are possible and the belt's extreme flexibility permits pulley diameters as small as ½ in. at 10,000 r.p.m. even with a heavy load.



Wet-Grinding Valve Refacer

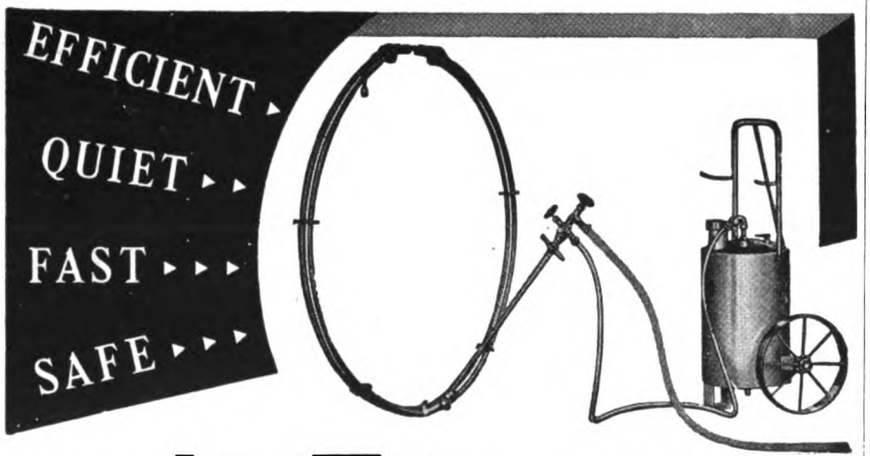
The Super-Service Valve Refacer, a completely new device has been introduced by The Black & Decker Mfg. Co., Towson 4, Md. This hypoid-gear-driven wet-grinding refacer supersedes all previous Black & Decker models.

An outstanding feature of the unit is that it will traverse grind all valves from 0 to 90 deg. It handles valve stems from $^{9}/_{32}$ to $^{11}/_{16}$ in. and has a valve head capacity up to 4 in. in diameter. The wheel head is at a 20 deg. offset permitting traverse grinding of any angle valve face including the flat type. No attachments are needed and plunge grinding is eliminated.

This machine is supplied with two collets and a hand wheel on the back of the work head has a double lead thread for giving quick clamp action on the stem in the collet. It is equipped for wet grinding allowing for cooler, faster grinding. A reservoir in the base holds 1 gal. of coolant and contains baffle plates to settle the grinding sediment.

Attachments for grinding valve stems, tappets and rocker arms are supplied as standard equipment. The wheel dressing attachment also standard equipment, is mounted on the work table and can be swiveled out of the way without removing when refacing a valve.

Wheel guards are cast integral with the wheel head; the motor for the wheel head as well as the coolant pump are in the base; wires, tubes, etc., are enclosed for safe operation; bearings are grease-sealed throughout and there is four-point bearing suspension on both work and wheel tables.



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FAST—the fire starts quickly without smoke or oil drip—nothing but finely atomized fuel can be fed to the ring.

EFFICIENT—there are no hot spots—heat is uniform. Air that lifts oil also atomizes it.

QUIET—operates quietly and economically on compressed air (40 - 125 lbs.) and kerosene or 38 - 40° B^2 distillate.

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Rough-Service Lamp

A smaller, 100-watt rough-service lamp that fits standard wire-guard extension-cord equipment is available from Westinghouse Electric Corporation. Applicable to all types of rugged service, this lamp emits more light from a smaller, more breakage-resistant bulb.

The new bulb is $2^{5}/_{8}$ in. in diameter, ¼ in. less than the former A-23 bulb. With a maximum length of $5^{5}/_{16}$ in. from top of bulb to bottom of base, it is ¾ in. shorter than the A-23.

Voltage ratings of the new lamp range from 115- to 300-volts, have corresponding approximate average initial lumens of 1,210 to 750. All ratings are designed for a life of 1,000 hr.

All 100-watt rough-service lamps of clear glass or inside frosted glass are now manufactured in the smaller size.

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MAY, 1951
Mechanical and Electrical Engineer

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MAY, 1951

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VOLUME 125 No. 5

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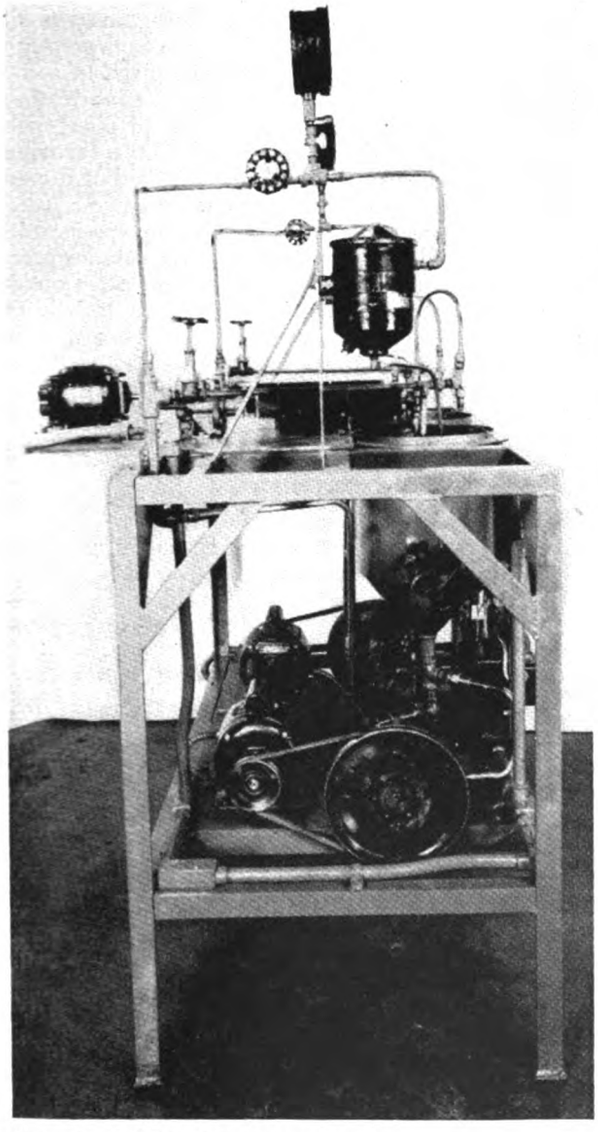
MAGNUS METAL CORPORATION

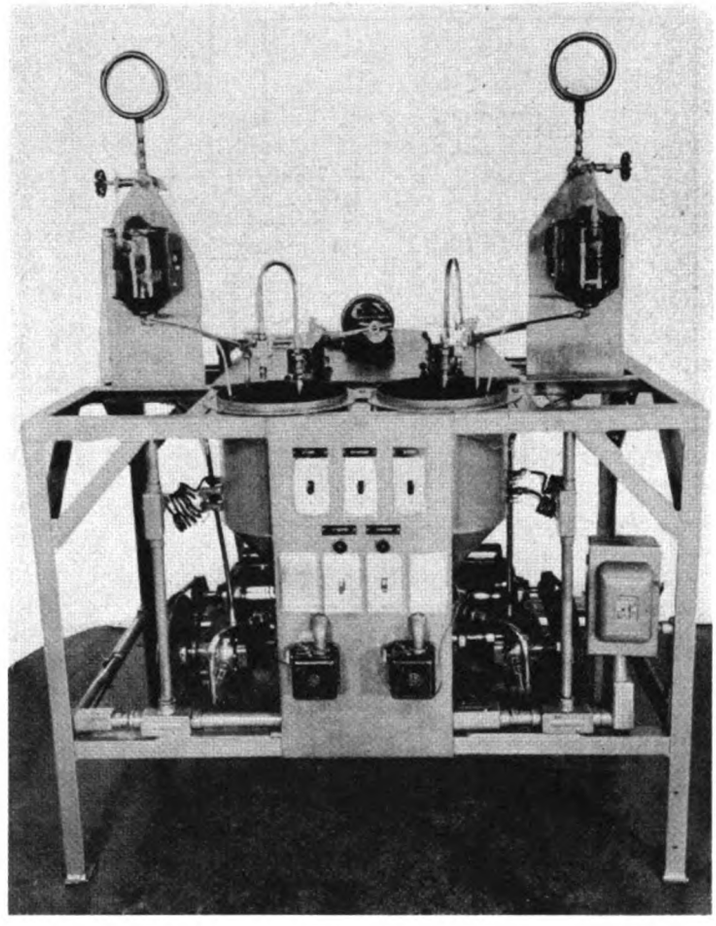
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RAILWAY Mechanical and Electrical Engineer

Engine Oil Pressure

By P. A. Binda†





Figs. 1 and 2—Laboratory equipment for studying engine-oil pressure

Part I

THE term "engine oil pressure" is often found in literature on engines, however, little is ever mentioned beyond stating a pound per square inch value at some speed condition for the particular engine involved. The question naturally arises as to why measure oil pressure continuously. The answer obviously is to note if oil pressure changes occur during engine operation; but the significance of these changes can sometimes be misinterpreted.

The lubrication system of an engine consists primarily of an oil pump and oil lines or galleries to feed bearings, timing gears, valve trains, cylinder walls and other lubrication points. To complete the system an appropriate relief valve is incorporated to confine the oil to the main galleries and to relieve peak cold oil pressures. If desired an oil filter may also be included in the system.

A variation is found in a system that incorporates a separate oil reservoir, otherwise known as a dry sump

* Abstract of a paper appearing in the Texas Company's technical publication Lubrication, March, 1951.

† Technical & Research Division, Texas Company.

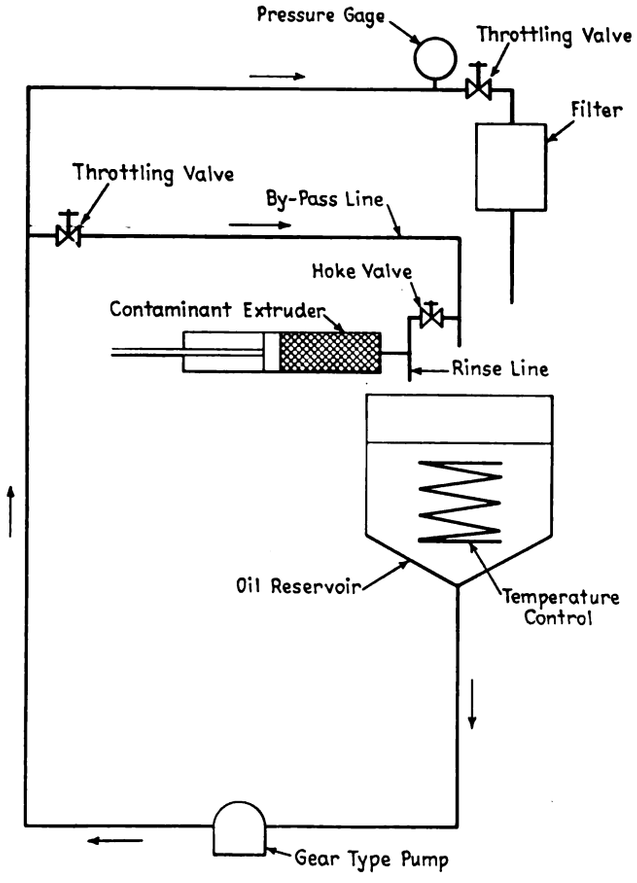


Fig. 3—Schematic diagram of an engine lubrication bench test

engine. Two separate oil pumps or a double pump in one body are used in this type of system.

Some engine manufacturers use a pressure system to all points except the connecting rod bearings and wrist pins. Connecting rod bearings are supplied with oil by equipping the rod bearing caps with dippers to scoop the oil from special troughs in the oil pan aided by impinging a stream of oil into the scoops by means of accurately aligned jets. In this system also it is obvious that oil flow rates are of major importance.

Large diesels usually have two separate oil systems. One system lubricates piston and cylinder liner walls while a crankcase system is used for lubrication of the remainder of the engine. Two different oils are usually used in this engine. Also, a secondary system is used on these engines to carry the crankcase oil to independent filtration equipment.

In all engines the oil is called upon to perform more than one service. The primary service is to maintain a continuous oil film between moving surfaces to prevent metal-to-metal contact. In addition the oil is required to carry away heat generated by friction (oil shearing), act as a piston-to-cylinder wall seal and in some cases to increase piston cooling. It is obvious that the rate of oil flow is an important factor if the oil is best to serve its intended purposes.

It is desirable to incorporate in an engine lubrication system some method of measuring oil flow. A variable closely related to fluid flow is pressure. Pressure gages are easy to incorporate in an engine lubricating system and are used as a means of assuring the operator that engine lubricating oil is flowing. However, it is difficult to

TABLE I—OIL VISCOSITY DATA

Oil Designation	*Viscosity, SUS At: 100 deg. F.*	*130 deg. F.*	*210 deg. F.*	*Viscosity Index*
P-6	1680	712	121	87
P-5	1220	475	93	88
P-4	830	348	78	91
P-3	547	242	67	97
P-2	331	156	54	96
P-1	172	93	44	98
N-6	1690	510	78	<0
N-5	1178	384	69	<0
N-4	764	280	60	<0
N-3	565	218	55	8
N-2	315	135	48	19
N-1	205	100	44	20
P-3C	523	235	66	102
N-4A	704	280	66	63
N-3S	691	247	57	<0

interpret pressure gage indications as rates of oil flow since many factors affect oil pressure in an engine.

The factors affecting oil pressure should be considered before drawing conclusions regarding fluctuations in oil pressure. To understand the significance of oil pressure gage indications, consideration should be given to some fundamentals of fluid flow. Assume that the lubrication system consists of a fixed size and length of pipe (galleries) with a definite size opening for leakage (bearing clearances, squirt holes and by-pass) with fluid at a constant temperature supplied by a constant volume (displacement) pump, which is the most common type used in engine practice. Under these conditions a definite pressure gradient and discharge pressure at the system outlet is established in the system. The only characteristic of the fluid that will change this pressure condition is viscosity. The other factors that would change these pressures are of a mechanical nature (change in leakage by a change in discharge outlet size or volume supply) or in temperature which again would only affect viscosity. It is recognized that pump discharge volume must be controlled in such a system since changes in viscosity or pressures affect pump output volume.

Before studying the effects of these variables in a simplified oil system or in actual engines, consideration should be given to the equations of fluid flow. A simplified version of the flow equation for fluids in closed paths (pipes) under laminar flow condition is:

$$V = \frac{PD^2}{CN} \qquad (1)$$

where V = Flow (volume)
P = Pressure change along flow path
D = Pipe diameter
C = Constant for proper dimensions
N = Viscosity

This equation states that laminar fluid flow in closed paths varies directly with pressure gradient and pipe diameter and inversely with viscosity. Also, a change in path diameter has a greater effect on the flow than either pressure drop or viscosity changes since flow varies as the square of the diameter. This equation is applicable in determining coefficients of rischarge for some types of orifices and by-pass outlets.

Considering the positive displacement pump usually found in an engine lubrication system, its performance can be described by the following equation:

$$V = Vp - Vs - Vc \quad (2)$$

where V = Actual delivery
Vp = Physical pump displacement delivery
Vs = Slip losses
Vc = Cavitation losses

This equation merely states that the actual delivery is equal to the delivery based on the physical capacity and speed of the pump less slip and cavitation losses. The slip losses may be quite large since they are similar to laminar fluid flow between flat parallel plates. The equation for this condition is:

$$Vs = \frac{PBT^3}{12CNL} \quad (3)$$

where Vs = Flow between close flat parallel plates
P = Pressure change along path
B = Width of passage
T = Clearance between plates
C = Constant for proper dimensions
N = Viscosity
L = Length of passage

This equation states that laminar flow between flat parallel plates varies with pressure gradient and viscosity in a manner similar to laminar flow in pipes, however, changes in clearance between plates, cubed functions, have a greater effect on flow than changes in pipe diameter. This equation may be applied in determining oil flow through bearing clearances.

The cavitation losses in an engine oil system under normal engine operating conditions are usually negligible. These losses can become detrimental, however, in cases of severe foaming or improper oil viscosity.

Since oil viscosity varies inversely as a function of temperature and this fact will be considered in the subsequent discussion, the viscosity-temperature relationship of two pairs of oils, of widely different viscosity and viscosity index has been included for information purposes. The relationship is not linear, an important fact. In the lower temperature range large changes in viscosity are experienced with small changes in temperature while at the higher temperatures the reverse is true.

Laboratory Simulated Lubrication System

To study some variables associated with engine lubricating oil systems in simplified laboratory equipment the units shown in different views as Figs. 1 and 2 were used. This equipment consists of two completely independent units. The schematic diagram of the individual units is shown as Fig. 3.

Each test unit consists, essentially, of a cylindrical reservoir with a conical bottom containing thermos-statically controlled heating coils, a constant volume (gear) pump, a by-pass line with a throttling valve to control pressures in the system, a filter line and an accurately-metered contaminant extruder so that the unit can be used for evaluating oil filters. The extruder was not used for the work presented herein. The units are such that they can be readily modified.

The oils used in this bench test type evaluator and in the engine tests to be discussed later are shown as Table I along with their viscosities and viscosity indices. It is pointed out that both naphthene and paraffin oils covering a wide range of viscosity grades and viscosity indices were included.

By using the test apparatus shown in Fig. 4 with the

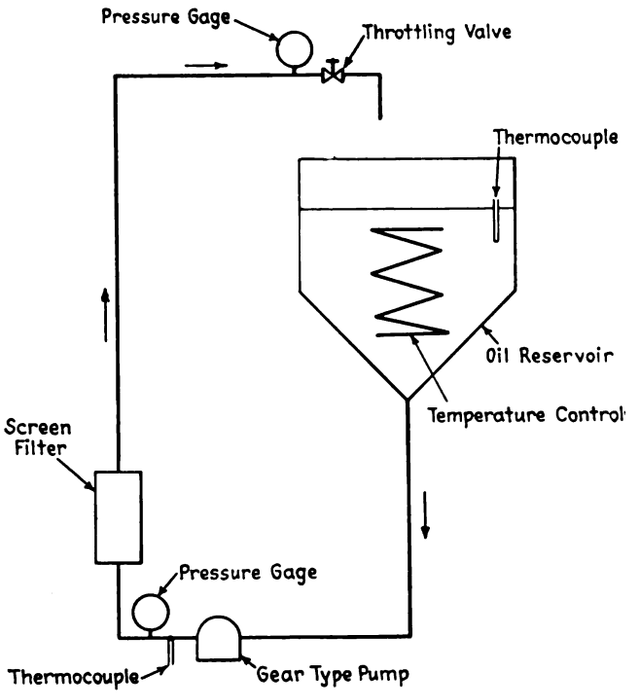


Fig. 4—Arrangement of a modified engine lubrication test system

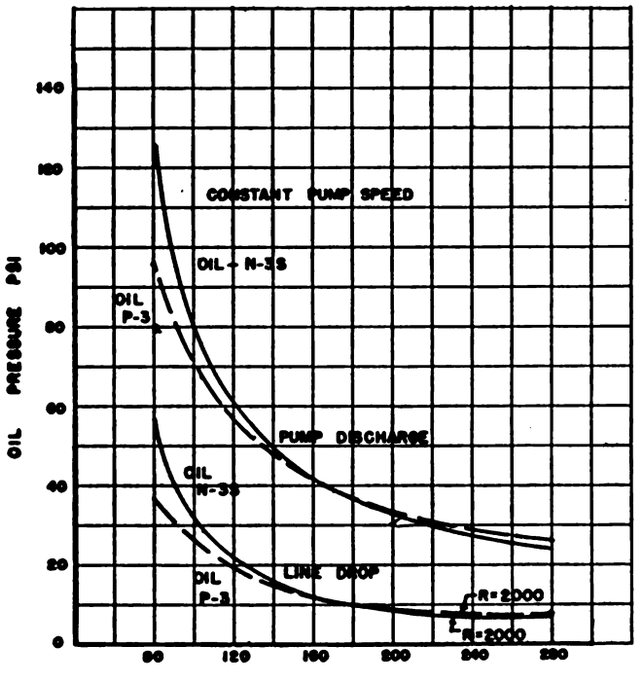


Fig. 5—Oil-pressure-temperature relationship for a simulated lubrication system

throttling valve used to restrict flow we have essentially the pipe arrangement assumed earlier in this article. Tests were carried out using two oils P-3 and N-3S (Table I) whose Saybolt viscosities were approximately equivalent at 130 deg. F. In the first test, pump speed was kept constant and oil temperatures at pump discharge were varied from 80 deg. F. to 280 deg. F. Essentially, oil viscosity was varied. The resulting pump discharge pressures and pressure drops through the line are shown as Fig. 5. These curves show that discharge pressures and line pres-

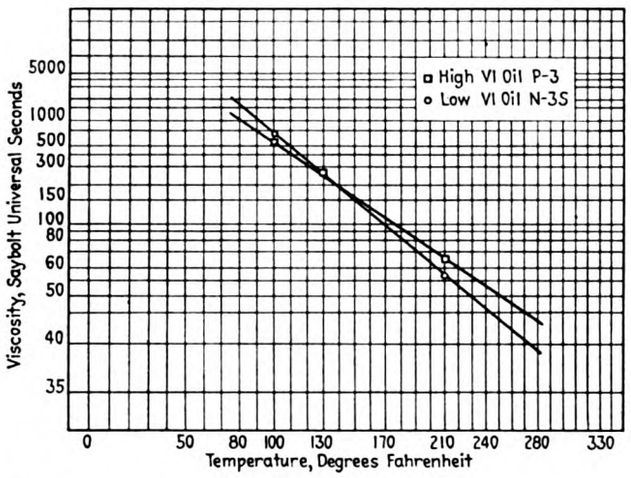


Fig. 6—Viscosity-temperature relationship for two typical oils

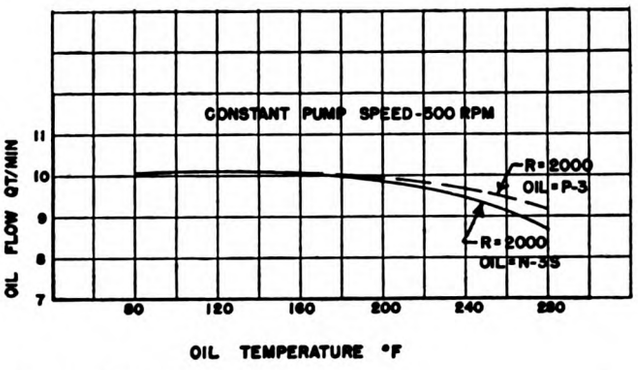


Fig. 7—Oil-flow rates for a simulated lubrication system

sure drops decreased with increased temperature (decreased viscosity). The low VI oil N-3S showed substantially greater discharge pressures and line pressure drops than the high VI oil P-3 in the 80 deg. F. region, but both oils were almost equivalent from 105 to 280 deg. F. These results appear logical in view of the viscosity of the low VI oil being 600 SU seconds greater at 80 deg. F. than that of the high VI oil while at 280 deg. F. the low VI oil is only 5 SU seconds lower than the high VI oil. This may be seen from the temperature-viscosity relationship of these oils, shown as Fig. 6. It may be noted that the absolute viscosities of the oils were equal at the respective oil temperatures where discharge and line drop pressures were equal.

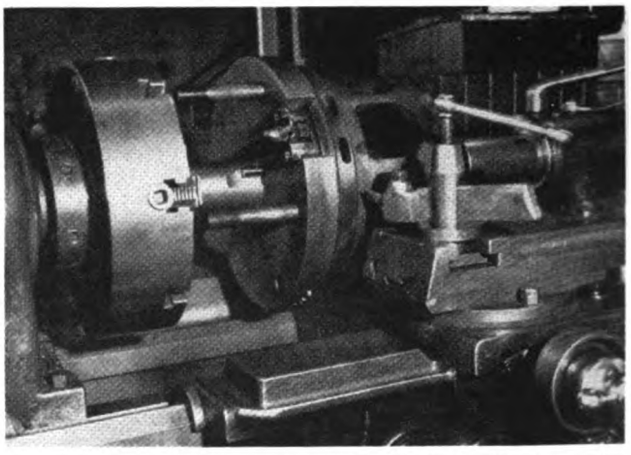
The oil rates determined in this test are shown as Fig. 7. The dimensionless quantity known as Reynolds Number (R), a parameter which characterizes the relative importance of viscous action, was computed for the severest condition based on viscosity of the oil at the pump discharge oil temperature. It was found on this basis that oil flow was laminar up to the points R indicated on the curves of Figs. 7 and 5. These are the Reynolds Number values of 2000, otherwise known as the lower limit below which flow disturbances of any magnitude are eventually damped by viscous action. All flows were below the upper critical Reynolds Number value of 12,000 or, in other words, instability of flow was not encountered.

From the equation of flow (1) it can be seen that for constant flow and pipe size, line pressure changes and consequently discharge pressures vary with viscosity. Since viscosity varies inversely as a function of temperature, then, in this equipment the oil pressure-temperature relationship curves should follow the same trend as the viscosity-temperature curves.

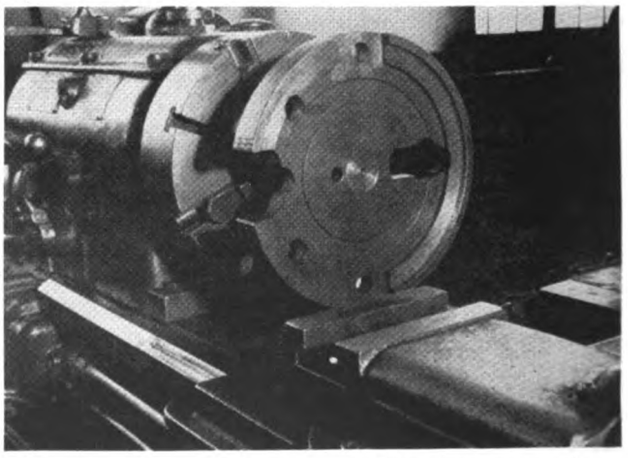
Mandrel To Face Diesel Engine Heads

The facing of a diesel engine head bottom and ring joint has been simplified by a mandrel built at the Oelwein, Iowa, shops of the Chicago Great Western. The design of the mandrel is such that it is easily applied to and centered in the lathe. It is relieved so that the facing can be done on the head without removing the overspeed trip, the rocker arm bracket or index.

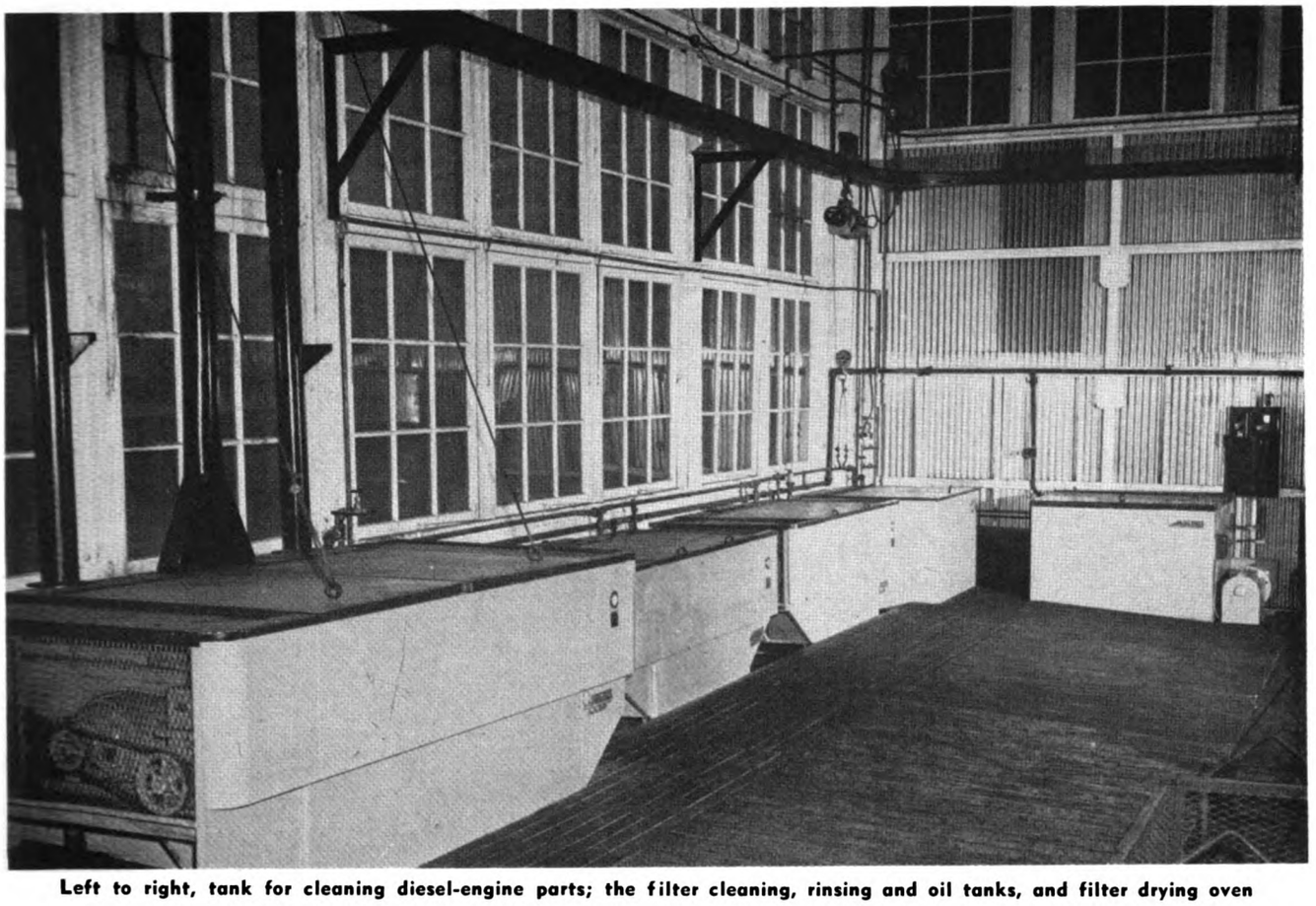
The application of the mandrel to the lathe is simple. The mandrel shaft slips in the spindle and an enlarged section of the shaft is grabbed by the chuck jaws. The lathe dead center fits in the injector hole to support the other end of the assembly. The head is applied to the mandrel by inserting the two rocker arm studs through appropriate holes in the mandrel plate.



Application of the head to the mandrel for facing the ring joint



The mandrel is relieved to avoid removal of the overspeed trip, the rocker arm bracket or index from the head



Left to right, tank for cleaning diesel-engine parts; the filter cleaning, rinsing and oil tanks, and filter drying oven

How the Western Maryland Cleans Air Filters

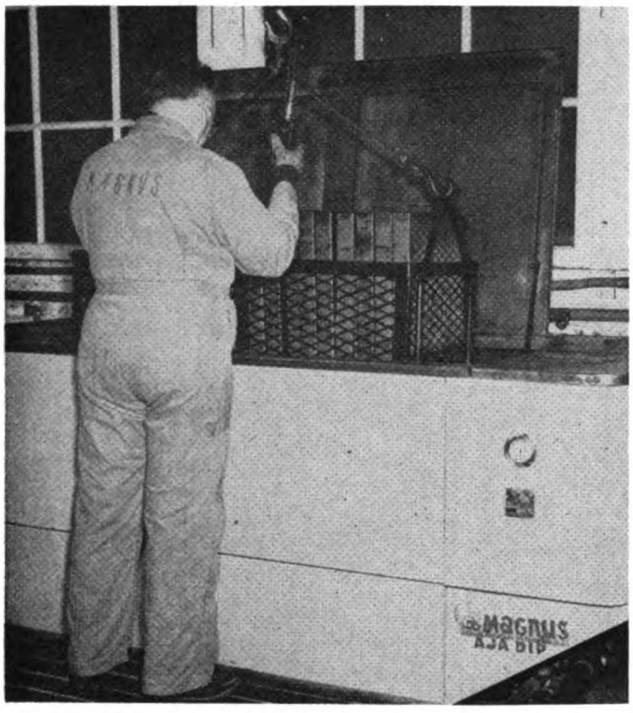
With the passing of the era of steam and the adoption of diesel-electric powered engines, the maintenance problems have become greater and more pressing. One of the maintenance problems confronting the mechanical department is that of cleaning. In the past, when steam locomotives prevailed, cleaning in the repair shop consisted mainly of soaking engine parts in a large vat of boiling alkai. In most cases this was entirely adequate as the parts to be cleaned were heavy cast iron units which were unharmed by strong alkaline solutions.

The problems of cleaning diesel engine parts differs extensively from those encountered in the cleaning of steam locomotive parts. The well-known "lye vat" had to give way to more modern cleaning compounds and methods of cleaning because of the variety of easily attacked metals and alloys used in the construction of the engine parts, the close tolerances and highly finished surfaces of these parts and the tenacious nature of the soil deposits resulting from the operation of internal combustion engines.

The Western Maryland at Hagerstown, Maryland, realized that to keep its diesel power on the road with "lay up" time cut to a minimum, mechanized cleaning of component locomotive parts would be a necessity. Too, they realized that the elimination of excessive labor costs for cleaning would be a direct result of the use of mechanical cleaning equipment and specialized cleaning compounds.

In determining the type of cleaning equipment and method best suited to their needs, several factors had to be given careful consideration. As both engine parts and air filters were the main units to be cleaned, equipment to handle both these dissimilar parts were needed. The equipment had to be compact because of space limitations. Because of the difference in the nature of the soil on the engine parts and filters, two kinds of chemical cleaners had to be used. The equipment had to be of the type that could be used intermittently without costly, time-consuming preparation.

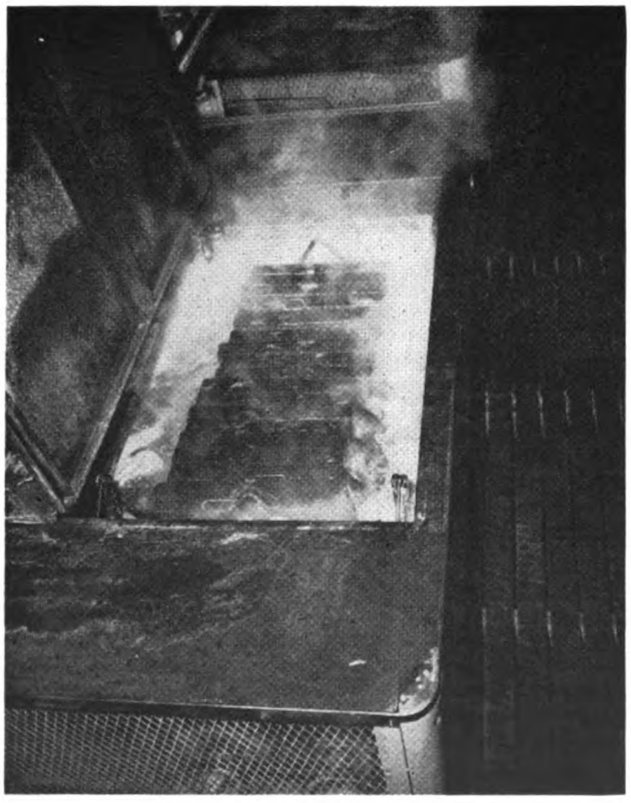
The cleaning room as finally planned, built and equip-

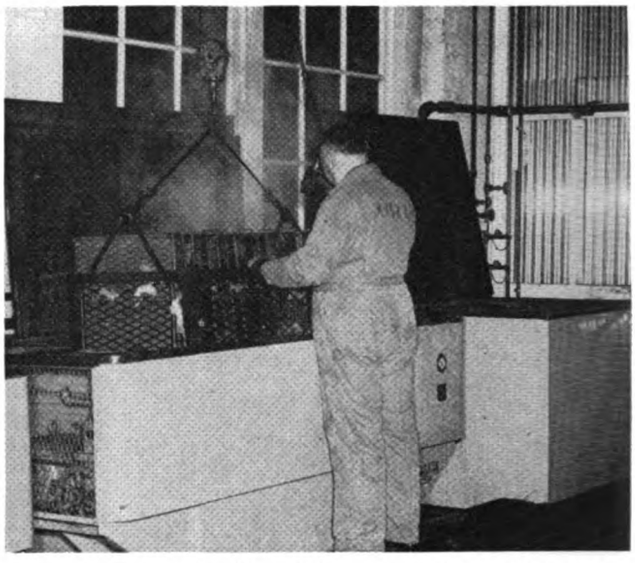


▲ A basket load of 18 air filters being lowered into mechanically agitated filter cleaning solution. Cleaning time, 1½ min.

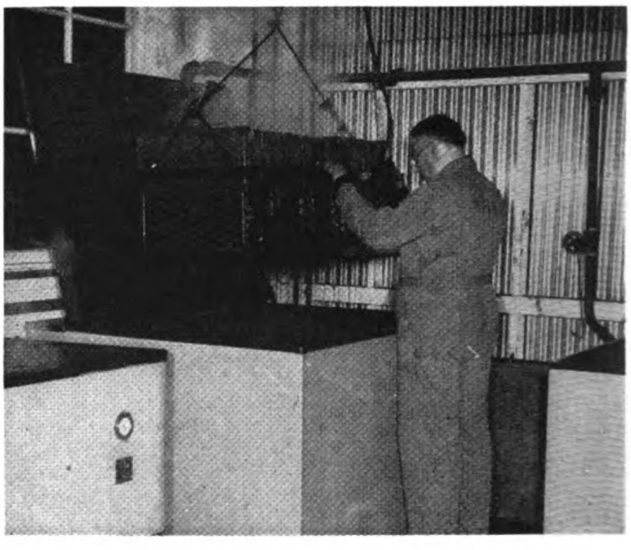
Filters draining after a few seconds' immersion in the hot-oil dip tank. Excess oil is allowed to drain back into tank ➤

▼ A batch of 18 filters being agitated in a solution of Magnus Super SL

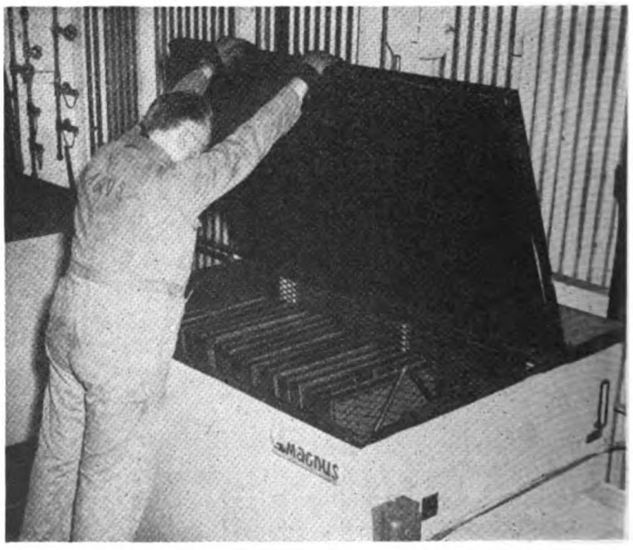




▲ Filters being removed from the rinsing tank after an immersion time of 1 min.



▼ The drying oven where the filters are placed for final drying after oiling



ped is located in one end section of the existing engine house, partitioned off from the rest of the house which, has been converted into a modern diesel overhaul shop.

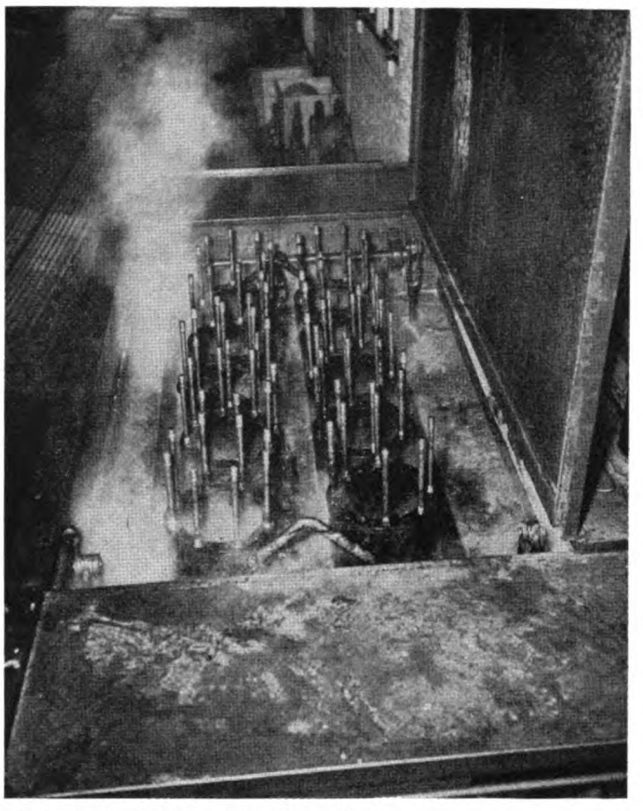
The Western Maryland cleaning room is itself a model of cleanliness and the equipment handles all diesel parts cleaning and filter cleaning, rinsing, oiling, drying and storing operations. It consists of one Magnus Aja-Dip cleaning machine No. 6 for cleaning diesel engine parts; two Magnus Aja-Dips No. 4, one for cleaning filters and one for rinsing filters; one Magnus Hot-Oil dip tank and one Magnus drying oven.

Before the installation of the above cleaning equipment, cleaning diesel parts and air filters required 24 man-hours a day (3 men—8 hours per day). Parts cleaning was done in an open tank in which the parts were immersed in cleaning solution and left for several hours or a full day to clean. Filters were cleaned by dipping individual filters in an open tank and then rinsing with steam . . . a time-consuming, hand operation. Not only were their former cleaning methods costly, but the actual cleaning results left much to be desired. Much time was unnecessarily consumed in handling parts and filters in and out of the cleaning tanks individually.

With the present set-up of Magnus cleaning equipment, efficiency is at a high level. Cleaning time for both diesel parts and air filters has been cut to 4 man-hours per day—a saving of 20 man-hours. It has released two employees for other work and also makes available for other work 4 hours per day of the cleaner.

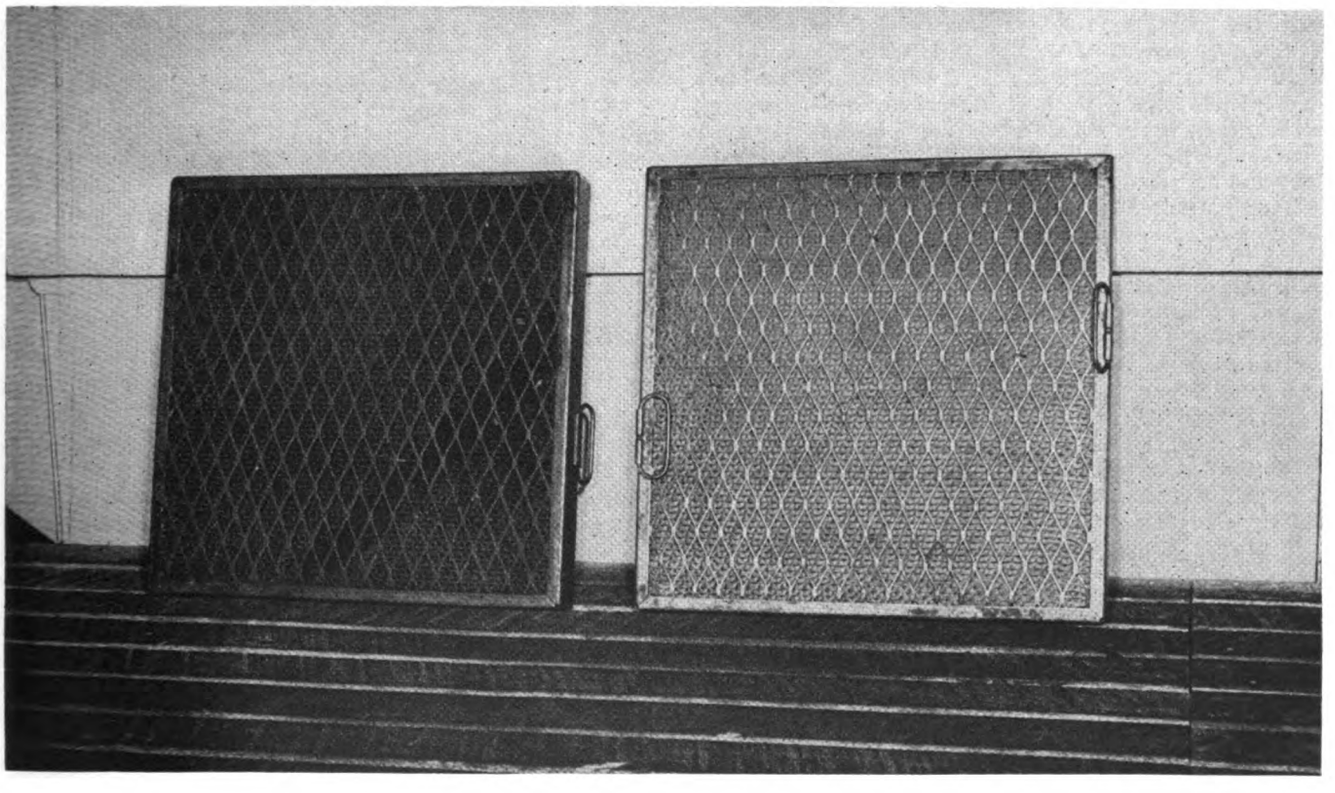
Individual handling of parts and filters has been entirely eliminated throughout the cleaning operations. As the engine that is being overhauled is dismantled, the parts to be cleaned are loaded directly into perforated baskets that fit the platform of the No. 6 Aja-Dip cleaning machine. An overhead, electric hoist picks up the baskets of parts and places them in the machine, containing Magnus decarbonizing compound heated to 140 deg. F. A touch of the starting button puts the agitating mech-

(*Continued on page 58*)



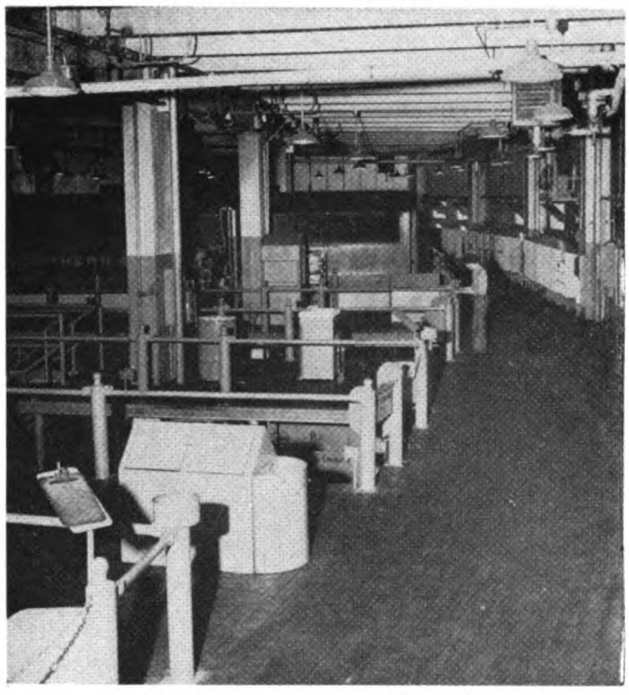
▲ A load of 10 cylinder liners being cleaned in a decarbonizing compound

▼ Two flat filters from the same engine. The filter on the left is before cleaning; that on the right, after cleaning and rinsing



Facilities for Diesel Repairs*

By R. H. Herman†



Working platform, storage cupboards and racks in extended portion of a converted enginehouse

THE following list covers the principal items of machinery and equipment for routine or progressive maintenance work. A shop for a relatively few number of locomotives will not require a complete set of such equipment since portable equipment can be borrowed or the work sent to other shops for routine test or overhaul.

1. Equipment for changing pair of wheels and traction motor. This may comprise pneumatic jacks, motor-driven high lift jacks, drop table or transfer table.

2. Crane and hoist service will include a crane or hoist of 5 tons or more in capacity for handling wheels and traction motor, main generator, steam generator or other heavy parts. Small 1- or 2-ton hoists should be provided, where necessary, on monorails or jib cranes for handling smaller parts. It may be desirable to provide a 2-ton or larger overhead traveling crane over the inspection pit tracks for handling parts through the hatches on the locomotive roof.

3. One or more engine lathes for machining operations, 12 in. to 30 in. swing.

4. One or more drill presses at convenient points in the parts reconditioning room and on working platform.

5. One or more double emery grinders of bench or pedestal type at convenient locations.

6. Welding and battery chargers of the portable type. A standard welding set of 400 ampere capacity may be equipped with necessary meters and relays for emergency battery charging.

7. A 20- to 50-ton hand or motor-operated hydraulic press for bushings, small shafts, etc.

8. One or more portable flexible shaft grinders and buffers.

9. Pipe cutting and htreading machine for pipe up to 2 in., with drive shaft and dies for larger pipes.

10. Air brake test benches with plates and accessories for all types of air brake equipment.

11. Speed recorder tester.

12. Hypot test outfit, 0-300 volts with circuit for burning out grounds.

13. Power and torque wrenches for crab nuts, main bearing cap nuts and similar applications.

14. Equipment for cleaning heads, liners, pistons, connecting rods, etc. This may consist of cleaning vats and rinse tanks in a small shop or agitating dip cleaning and rinse tanks in a large facility.

15. Equipment for cleaning and oiling air filters. Solution, rinse and oil tanks may be used with steam heated ovens in a small shop. In a larger shop appreciable labor savings can be realized by installing a continuous conveyor type cleaning machine and centrifugal oiler or a combination batch type cleaning and oiling machine.

16. Magnaflux, Magnaglo and Zyglo equipment for testing axles, gears and pinions, rods, pins, bushings, valves, pistons, heads and other highly stressed parts.

17. Test stand for engine governor.

18. Impact wrenches for various applications.

19. Megger tester, voltmeter, ammeter, ohmmeter and instruments for electrical work as well as testing.

20. Valve seat and face grinding machines and accessories.

21. Gasoline or electrically-operated platform trucks for handling material.

22. Lift platform electric truck for handling skids and batteries.

23. Pneumatic jacks of 50 ton capacity for lifting locomotive cab when dropping wheels or inspecting center castings.

24. Tachometers and speed indicators for checking engine speed.

25. Injector test equipment.

26. Hand carts of various types for handling cylinder assemblies, filters and other frequently used parts.

27. Small MG set for testing meters and relays.

28. Equipment for lube oil reclamation in a large shop with storage tanks and pumping equipment for new and reclaimed oils.

29. Equipment for tests of viscosity and condition of lube oil from Diesel engine crankcases, supplementing regular laboratory analysis. It may even be desirable at a large shop to provide a branch chemical laboratory to permit a close check of lube oil condition or contamination.

30. Equipment for cleaning radiator and oil cooler

* The third of several articles which constitute an abstract of material appearing in the 1951 Edition of the Locomotive Cyclopedia, Shop Section

† Engineer Shops and Equipment, Southern Railway System

cores with small amount of equipment for sheet metal work.

31. Oxy-acetylene welding equipment.

32. Induction heater for inner bearing races on locomotive.

33. Pinion heater and hydraulic pinion puller with accessories for mounting and dismounting traction motor pinions if required.

34. Necessary hand tools, special jigs and tools, fixtures and devices for Diesel repair operations.

Servicing Facilities for Routine Maintenance

The following facilities will be required in conjunction with the well designed maintenance shop.

1. Washing platform with concrete walkways and reinforced concrete walkways and reinforced concrete supporting track long enough for a complete locomotive or several locomotives in a large operation. Service outlets should be provided for cold water, steam, compressed air, cleaning solution for trucks and underframe and the entire area should be well lighted. If the number of locomotives handles justifies the expenditure a rotating brush-type washing machine is very desirable.

2. An outside inspection pit, well lighted and drained, for turnaround inspections.

3. Sanding facilities including wet sand storage, sand dryers of steam, coal or oil fired type, elevated dry sand tanks with piping, hoses and nozzles to reach sand boxes on locomotive units. Elevated walkways at each side of the track are very convenient.

4. Water treating system for boiler and engine cooling which may cover water distilling equipment, demineralizer, softener or chemical treating tanks, complete with necessary storage tanks, pumps and pipe system to convenient locations on wash platform, inspection pit or in the maintenance shop.

5. Fuel oil storage, pumping and piping system to supply fuel oil to locomotive units on washing or outside servicing platforms. It is desirable that storage be sufficient to cover 60 days' consumption in event an emergency affects deliveries of oil. Duplicate pumping units of 100 to 300 or more gal. per min. capacity should be provided with intake screen filters, and large renewable element filters on the discharge. Some recent installations have been made using submerged turbine or centrifugal pumps, but common practice favors a rotary pump.

6. Lube oil storage, pumping and piping system. In a small shop lube oil changes in Diesel engines can be handled satisfactorily by pumping by hand from drums, but a shop of any size should have a complete pipe system throughout the shop with storage tanks and pumps to supply lube oil by hose and nozzle direct to the filling sump on the Diesel engine. The storage tank or tanks should be of adequate size to permit unloading of a complete car of oil at one time and should be steam heated. Pumps should be of the rotary type, motor driven, with a capacity of 30 to 60 gal. per min. depending on the number of outlets to be used at one time.

The outlets may consist of hose and nozzle suspended from an upright pipe, or a hose reel which will handle up to 50 ft. of hose, located at convenient points on the platform. Each outlet should be provided with an integrating or ticket printing meter for accurate record of the amount of lube oil supplied to each engine.

A pressure system for supply of lube oil eliminates frequent starting and stopping of manually controlled pumps. A pressure tank is used with approximately one-third of the tank filled with compressed air. When any supply valve is opened oil flows due to the expansion of air until the pressure drops to a predetermined point, at which the lube oil pump is started by a pressure switch.

7. A dirty lube oil system is also essential, with suction outlets under the platform, connected by hoses to engine sump and oil filter drain, with a pipe system to a rotary pump. The pump develops a suction in the system, draws dirty lube oil back and discharges it into a storage tank. At intervals the oil is pumped into barrels for shipment or to a reclaiming plant for reconditioning.

The clean and dirty lube oil lines should be installed together, with a small steam tracer line in between, all wrapped with blanket insulation. The steam line can be thermostatically controlled to maintain oil temperature high enough for easy flow.

8. A treated water system should also be provided in the larger shops for engine cooling water. The treatment generally used is costly and it has proven economical to salvage and reuse cooling water, when necessary to remove it for liner or other engine maintenance work.

The shop can be provided with two pipe systems, pumps and storage tanks to permit this water to be salvaged and reused. The water is pulled back from the locomotive, when not contaminated with oil, and discharged into a storage tank. The amount of treatment is checked, chemicals or water added and the water pumped into a treated water supply tank. From this tank, a pump delivers it to outlets at convenient points on the platforms for adding to or filling the engine cooling system. A pressure tank arrangement is also desirable on the treated water system.

9. An acid boiler wash system is desirable in a shop handling a large number of passenger Diesel locomotives having steam generators. A permanent piping system of copper or bronze can be provided and the acid washing unit permanently installed. The acid is circulated by the pump through the pipe system and steam generator coils and returned to the storage tank. This arrangement eliminates haulage of a portable acid washing unit from one platform to another with its attendant hazards.

10. Adequate fire protection is important and it should be provided by hydrants outside with foam protection, fog spray and carbon dioxide extinguishers inside.

11. Adequate ventilation must be provided to remove fumes and exhaust gases from the building. In the early shops, jacks or low hoods were used but proved to be unsatisfactory. Most shops now being built utilize motor driven or gravity ventilators on the roof to exhaust fumes. In sections of the country where climate is severe the incoming air should be tempered by heaters and admitted below the platforms for best circulation. This is not essential where winters are mild.

12. The building should be well lighted with battery charging and welding receptacles, extension cord receptacles, and steam, water and compressed air outlets at convenient points.

13. A paint shop for Diesel locomotive units is a very desirable feature at a large progressive maintenance shop since it will no doubt be necessary to paint cabs, etc., before locomotive is shopped for heavy repairs.

14. Ramps and stairs should be provided at convenient points for passage of employees or haulage of material from one level to another. An elevator or hydraulic lift is economical for transporting material in a large shop.

15. It is essential that provisions be made for a storehouse as close as practicable to the Diesel shop. Platform should be provided for loading and unloading material from cars or trucks, with passageway from these platforms to the maintenance shop.

(To be continued)

16. A communications system consisting of loud speakers with talk-back arrangement or telephones at convenient locations about the shop and terminal area is essential in a large shop. The master control station should be located in the shop office but it should be possible to make announcements over the speaker system from any telephone.

17. In colder areas of the country some means should be provided for thawing or melting ice or snow from trucks and underframe. This can be accomplished by hot air outlets in the pit or a portable de-icer unit operating inside the inspection pit.

Cleaning Diesel Air Filters

(Continued from page 55)

anism into motion, agitating the basket load of parts up and down in the cleaning solution 54 times a minute. After the short cleaning period, the parts are given a steam rinse and returned to the repair crew.

While the diesel parts are being cleaned (one to three hours depending upon the tenacity and amount of varnish and carbonized oil on the parts) the operator is free to clean air filters.

As the filters are removed from the engine, they are placed in perforated baskets designed to fit the No. 4 Magnus Aja-Dip filter cleaning machine. A basket load consists of 18 filters. From the time the filters are placed in the baskets until final drying has been completed the 18 filters are handled as a unit and do not require individual handling.

The overhead electric hoist and trolley places the basket of filters in the No. 4 Aja-Dip where they are agitated for 1 to 1½ minutes in a water solution of Magnus Super SL cleaning compound. The reversing, up and down motion of the filters forces the cleaning solution through the filters from all directions, effectively loosening and carrying away all impinged dirt deposits, resulting in thoroughly cleaned filters, corner to corner; through and through.

At the end of the 1- to 1½-minute cleaning period, the basket of filters is removed from the cleaning machine and placed in the next Magnus No. 4 Aja-Dip. Here they are given an agitated rinse in hot water for one minute. From the rinsing machine the filters are dipped for less than one minute in the heated oil bath contained in the Magnus hot oil dip tank. After a short period to allow excess oil to drain back into the tank, the filters are moved to the Magnus drying oven. Excluding drying time (approximately 15 minutes) the cleaning, rinsing and oiling operations consume the unbelievingly short time of less than 5 minutes.

Filters that have just been cleaned are not put back in the same engine from which they were removed as a supply of extra, cleaned and dried filters is kept in stock. To stock recently cleaned filters, the Western Maryland designed and built an ingenious storage bin. The drawers of the cabinet rock open, making the filters easily available. Additional storage place is provided at the top of the cabinet for storing round-type filters. The storage cabinet is gas heated to prevent stored filters from picking up atmospheric moisture.

On the Western Maryland filters are changed frequently on all engines, the frequency of replacement depending upon the type of service in which the engines are placed. With the present air filter cleaning procedure, it is possible ot keep well ahead of the need for clean filters because of the efficiency and speed with which filters are cleaned.

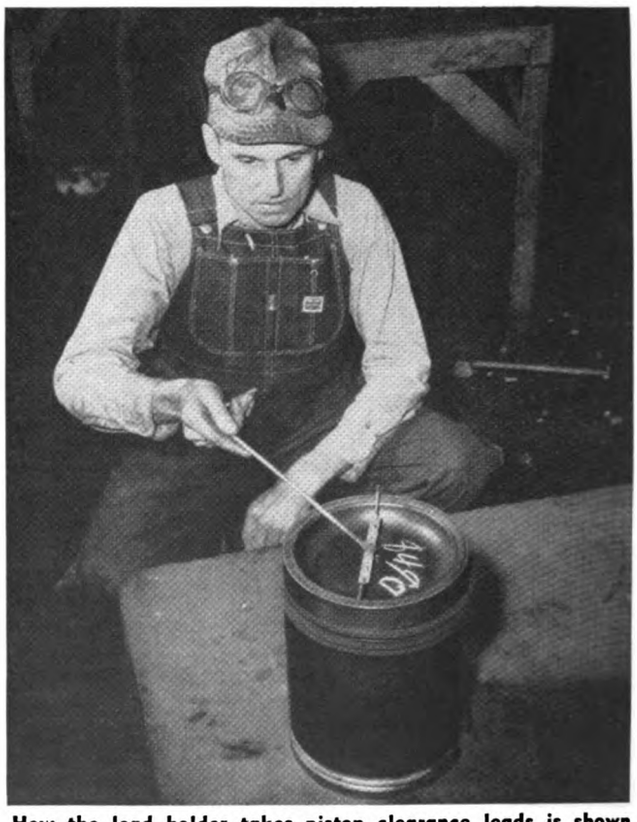
Applies and Holds Piston Clearance Leads

Both the taking and the recording of diesel engine piston clearance leads are simplified by a small device which holds the leads and which is numbered to correspond with the cylinder number on which the particular clearance lead is being taken.

The leads are bent into a Z shape with a 3-in. upper bar and a small lower bar. The small bar fits in a pair of ⅛-in. holes near the ends of a thin metal strip ½ in. by 5 in. A ¼-in. rivet ⅜ in. long is soldered in the center of this thin metal strip and drops into the center hole in the top of the piston.

The rivet serves also as the means by which the strip is applied for taking the leads. A rod ¼ in. by 18 in. with a Y shaped end lifts the strip by the head on the rivet. The end of the rod slips into the space between the bottom of the rivet head and the top of the strip. The strip is then applied through an air port in the bottom of the liner when the piston is on or near bottom dead center.

Sixteen such devices are used, one for each cylinder, to take the leads on a complete diesel engine.



How the lead holder takes piston clearance leads is shown above with the piston removed from the engine. In practice, the holder is inserted through the cylinder port

Diesel–Electric Locomotive Units In Railway Service

Class I railroads' Diesel-electric locomotive inventory increased by nearly 30 per cent in number of units and more than 30 per cent in horsepower in 1950

As of December 31, 1950, there were 15,340 Diesel-electric locomotive units in railway service, of which 14,147 units were owned by Class I, line-haul railroads, in the United States (excluding switching and terminal companies).

The Diesel-electric locomotive inventory of Class I, line-haul railroads, was increased by 3,174 units, totalling 4,432,137 hp.—from 10,973 units aggregating 14,009,850 hp. as of December 31, 1949, to 14,147 units, totalling 18,441,987 hp. as of the same date in 1950. This increase included 11 units of 2,500 hp.; 100 units of 2,250 hp.; 11 units of 2,000 hp.; 283 units of 1,600 hp.; and 1,792 units of 1,500 hp.

Switching and terminal companies and Class II and III railroads owned 1,193 Diesel-electric units aggregating 1,072,677 hp. as of December 31, 1950.

The Diesel-electric locomotive units in service on Class I, line-haul railroads (excluding switching and terminal companies), as of December 31, 1950, were as follows:

Number of Units	Horsepower Each Unit	Total Horsepower
36	3,000	108,000
11	2,500	27,500
119	2,250	267,750
1,275	1800 or 2000	2,543,200
283	1,600	452,800
5,647	1,500	8,470,500
1,173	1,350	1,583,550
5,603	1,200 or less	4,988,687
Total 14,147		18,441,987

A similar tabulation was published in the May 27, 1950, issue of the *Railway Age* and the July, 1950, issue of *Railway Mechanical and Electrical Engineer*, covering Diesel locomotive statistics for the previous year.

DIESEL-ELECTRIC LOCOMOTIVE UNITS IN SERVICE ON CLASS I RAILWAYS
Excluding Switching & Terminal Companies—As of December 31, 1950

	Number of Units in Various Horsepower Classes*								Total	
Railroad	3000	2500	2250	1800 or 2000	1600	1500	1350	1200 or less	Units	Horsepower†
Akron, Canton & Youngstown	....	....	....	4	....	1	....	2	7	11,500
Ann Arbor	....	....	....	....	14	....	....	9	23	28,720
Atlanta & St. Andrews Bay	....	....	....	....	....	1	....	12	13	13,500
Atlanta & West Point—W. of Ala	....	....	....	....	....	10	....	6	16	21,000
Atlantic & Danville	....	....	....	....	....	6	....	...	6	9,000
Atchison, Topeka & Santa Fe	....	....	....	66	1	336	320	244	967	1,299,830
Atlantic Coast Line	....	....	5	59	....	101	72	43	280	422,750
Baltimore & Ohio	....	....	8	44	....	224	24	213	513	674,160
Bangor & Aroostook	....	....	....	2	....	32	....	4	38	56,000
Bessemer & Lake Erie	....	....	....	....	....	21	....	2	23	33,030
Boston & Maine	....	....	1	21	....	34	68	70	194	238,950
Central of Georgia	....	....	2	10	....	19	....	25	56	74,980
Central of N. J.—Cent. of Pa	....	....	....	6	12	44	....	43	105	133,460
Central Vermont	....	....	....	....	....	....	....	3	3	3,000
Charleston & W. Carolina	....	....	....	....	....	14	....	2	16	23,400
Chesapeake & Ohio, incl. P.M	....	....	....	12	16	90	....	145	263	332,980
Chicago & Eastern Illinois	....	....	....	3	....	56	....	24	83	109,400
C. & N. W.—C. St. P. M. & O	....	....	4	42	....	157	8	167	378	477,510
Chicago, Burlington & Quincy	....	....	22	58	....	123	74	171	448	610,400
Chicago Great Western	....	....	....	9	....	76	....	42	127	169,715
Chicago, Indianapolis & Louisville	....	....	....	....	....	47	....	10	57	79,700
Chicago, Milwaukee, St. P. & Pac	....	....	....	35	....	122	52	147	356	453,540
Chicago, Rock Island & Pacific	....	....	1	31	15	89	48	152	336	396,360
Clinchfield	....	....	....	....	....	22	....	6	28	40,200
Colorado & Southern	....	....	....	2	....	12	....	5	19	27,200
Colorado & Wyoming	....	....	....	....	....	....	....	3	3	3,000
Columbus & Greenville	....	....	....	....	....	5	....	2	7	8,632
Delaware & Hudson	....	....	....	....	....	49	....	50	99	123,500
Delaware, Lackawanna & Western	....	....	....	....	....	59	20	54	133	155,040
Denver & Rio Grande Western	....	....	....	6	....	79	48	37	170	226,760

* Number of Units Based on A. A. R. Statistics. † Horsepower Compiled by the Simmons-Boardman Publishing Corporation.

DIESEL-ELECTRIC LOCOMOTIVE UNITS IN SERVICE ON CLASS I RAILWAYS—CONTINUED

Railroad	Number of Units in Various Horsepower Classes								Total	
	3000	2500	2250	1800 or 2000	1600	1500	1350	1200 or less	Units	Horsepower
Detroit & Mackinac	....	....	....	....	....	6	....	1	7	9,660
Detroit & Toledo Shore Line	....	....	....	....	....	....	....	3	3	3,600
Detroit, Toledo & Ironton	....	....	....	....	....	....	....	14	14	14,200
Duluth, So. Shore & Atlantic	....	....	....	4	4	....	....	7	15	21,000
Elgin, Joliet & Eastern	....	....	....	32	....	10	....	107	149	169,900
Erie	....	....	....	12	24	154	24	125	339	441,280
Florida East Coast	....	....	....	26	....	18	....	...	44	79,000
Ft. Worth & Denver City	....	....	2	2	....	12	....	5	21	31,100
Georgia & Florida	....	....	....	....	....	6	....	3	9	10,800
Georgia	....	....	....	....	....	10	....	8	18	23,000
Grand Trunk Western	....	....	....	....	....	22	....	36	58	67,700
Great Northern	....	....	....	13	....	205	96	110	424	570,860
Green Bay & Western	....	....	....	....	....	9	....	4	13	16,420
Gulf Coast Lines	....	....	....	2	....	44	....	16	62	84,050
Gulf, Mobile & Ohio, incl Alton	....	....	....	17	8	153	....	65	243	339,740
Illinois Central	....	....	4	22	....	2	4	102	134	163,980
Illinois Terminal	....	....	....	....	....	....	....	19	19	19,000
International-Great Northern	....	....	2	4	....	36	....	11	53	74,760
Kansas City Southern	....	....	....	11	....	47	....	35	93	129,160
Lake Superior & Ishpeming	....	....	....	....	....	5	....	...	5	7,500
Lehigh & Hudson River	....	....	....	....	11	....	....	...	11	17,600
Lehigh & New England	....	....	....	....	....	26	....	7	33	45,440
Lehigh Valley	....	....	....	14	10	56	8	92	180	223,660
Long Island	....	....	....	8	....	1	....	45	54	55,240
Louisiana & Arkansas	....	....	....	3	....	22	....	12	37	51,000
Louisville & Nashville	....	....	....	28	....	67	....	107	202	245,720
Maine Central	....	....	....	7	....	23	....	25	55	66,360
Midland Valley-K. O. & G.-O. C.-A.-A	....	....	....	....	....	6	....	1	7	10,000
Minneapolis & St. Louis	....	....	....	....	....	14	9	43	66	72,950
Minneapolis, St. P. & S. Ste. M	....	....	....	....	....	76	....	18	94	130,980
Missouri-Illinois	....	....	....	....	....	1	....	1	2	2,500
Missouri-Kansas-Texas	....	....	8	6	17	68	....	20	119	177,600
Missouri Pacific	....	....	6	22	14	154	24	75	295	408,200
Nashville, Chatt. & St. Louis	....	....	....	....	....	69	....	38	107	138,920
New York Central System	....	....	4	103	8	242	10	469	836	958,760
New York, Chicago & St. Louis	....	....	....	11	....	....	....	71	82	93,440
New York, New Haven & Hartford	....	....	....	87	30	62	....	159	338	430,620
New York, Ontario & Western	....	....	....	....	....	7	18	24	49	56,940
New York, Susquehanna & Western	....	....	....	....	....	....	....	22	22	20,380
Norfolk Southern	....	....	....	....	....	10	....	8	18	20,780
Northern Pacific	....	....	....	....	....	99	44	64	207	270,740
Northwestern Pacific	....	....	....	....	....	8	....	2	10	12,760
Pennsylvania	22	11	10	187	27	246	....	662	1,165	1,452,590
Pennsylvania-Reading Sea Shore Lines	....	....	....	....	....	6	....	...	6	9,000
Pittsburgh & Lake Erie	....	....	....	4	....	....	....	37	41	45,000
Pittsburgh & West Virginia	....	....	....	4	....	....	....	1	5	9,000
Reading	....	....	....	....	....	54	20	117	191	212,560
Richmond, Fredericksburg & Potomac	....	....	10	....	....	23	....	22	55	79,000
St. Louis-San Francisco	....	....	17	6	....	178	....	84	285	396,190
St. Louis Southwestern	....	....	....	3	....	15	20	36	74	92,300
Sacramento Northern	....	....	....	....	....	....	....	7	7	2,880
Seaboard Air Line	14	....	6	54	54	114	44	62	348	541,220
Southern Pacific (Pacific)	....	....	1	42	....	452	....	162	657	910,130
Southern System	....	....	....	35	14	324	70	174	617	842,900
Spokane International	....	....	....	....	....	....	....	9	9	9,000
Spokane, Portland & Seattle	....	....	....	1	....	42	....	25	68	89,320
Staten Island Rapid Transit	....	....	....	....	....	....	....	8	8	6,800
Tennessee Central	....	....	....	....	4	6	....	5	15	19,720
Texas & New Orleans	....	....	....	12	....	56	....	67	135	174,260
Texas & Pacific	....	....	....	10	....	64	....	24	98	140,800
Texas Mexican	....	....	....	....	....	4	....	14	18	16,120
Toledo, Peoria & Western	....	....	....	....	....	10	....	3	13	18,000
Union (Pittsburgh)	....	....	....	....	....	24	....	95	119	117,540
Union Pacific	....	....	....	65	....	287	....	199	551	764,480
Wabash	....	....	6	8	....	81	....	72	167	216,620
Western Maryland	....	....	....	....	....	31	....	23	54	66,560
Western Pacific	....	....	....	....	....	51	48	28	127	165,380
Total	36	11	119	**1,275	283	5,647	1,173	5,603	14,147	18,441,987

** Includes 34-1800 horsepower units.

Note: Since the number of Diesel-electric locomotive units in the above tabulation were based on A. A. R. statistics, only those units, received by the railroads from the builders, that were reported to the A. A. R. as installed in 1950, were included.

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Changes in 1951 Interchange Rules*

Part II

By T. J. Boring†

Rule 70

Section (g)—Modified to provide that road issuing defect card for cut journal must assume charge for difference in value between multiple-wear, as well as one-wear, wrought-steel wheels applied by intermediate road in place of serviceable cast-iron wheels standard to car. The same applies when multiple-wear are applied in place of one-wear wrought-steel wheels.

Rule 74

Second Paragraph—Modified to provide that cast-iron wheels, single plate, of 80,000 lb. capacity or over, are condemnable when flanges have flat vertical surface extending 7/8 in. or more from tread, or flanges 1 1/16 in. thick or less, gaged at point 3/8 in. above tread. The one-inch condemning limit or opening for flange thickness in Figs. No. 1 and 3 (pages 154 and 156) Wheel Defect gage has been increased to 1 1/16 in., and the 1 1/8-in. opening in the left half of Fig. No. 7 Remount gage on page 167 has been increased to 1 3/16 in. These changes, and the reduced flat vertical flange surface limit, provide closer limits and will condemn such cast-iron wheels sooner than heretofore. Corresponding changes are being made to the Limit Wear and Master Gages shown in the Association of American Railroads Manuals.

Rule 76

First and second paragraphs—Modified by changing reference to Fig. 4-E in first paragraph to relettered Fig. 4-F covering tread worn hollow cast wheels, and adding new Fig. 4-E to the second paragraph covering tread worn hollow (or high flange) wrought-steel wheels, this new Fig. 4-E being same as Fig. 128 of the Wheel and Axle Manual and still referred to in this Rule.

Rule 86

Third Note following table Standard Axles, Limits of Wear and Dimensions, New—Eliminated account table covering "Tubular Railway Axle for all Purposes-Limits of Wear and Dimensions, New" transferred from P. C. Rule 7 to this rule, as tubular axles are used mainly under freight equipment cars.

Rule 88

Third item, Wooden draft timbers in place of metal draft arms extending beyond bolster—Eliminated account obsolete.

Rule 91

Section (a)—Addition of new Paragraph—Billing repair cards returned for adjustment of exceptions should either be marked to indicate bill number of billing railroad and reference to date of bill in which charge was included, or the bill number should appear on correspondence in connection with exceptions taken.

Interpretation No. 5—Modified to provide increased time limit for the handling of exceptions taken by car owner to repair charges.

Rule 94

Second paragraph—Modified to clarify the intent relating to basis for computing depreciated value less salvage of damaged cars dismantled instead of repaired, under provisions of this rule, on authority of defect cards.

Rule 95

Second paragraph—Modified to clarify the intent that *any type* of follower is intended when lost with draft gear, being the same responsibility.

Rule 101

Material Charges—Price adjustments have been made in line with recent quotations resulting in most items being somewhat increased. A resume of 48 of the items most often used in repairs, shows that present prices have increased six per cent which is an increase of 90 per cent over January 1, 1946, prices. All prices included seven per cent Stores expense, one per cent interest on stock investment and approximately one per cent for commercial and deadhead freight haul. The following principal changes have been made in this rule:

Items 46 and 47, Notes—Modified to provide that where service and emergency portions of AB brakes are renewed on authority of defect card account *damaged by fire*, they must be returned to the manufacturer to be re-conditioned to justify charges under these Notes (55 per cent value new plus COT&S charge). Otherwise, charge must be confined to COT&S only. Therefore, it will be necessary to follow these fire damaged AB service and emergency portions through the air brake shop to establish basis for charges on defect card.

Items 99, Note preceding—Modified to eliminate the exception to full charge for extra heavy pipe fittings applied to hand rails on tank cars. *New Item 100-A*—Added to provide charge for Flextite Split Sealing Gaskets (To be used in reinforced flange fittings only).

* Abstract of a discussion of the changes in Interchange Rules presented at a meeting of the Eastern Car Foremen's Association, New York, February 9, 1951.

† General foreman, M.C.B., Clearing House, Pennsylvania.

TABLE I

Year	Forgings	M. I.	C. S.	Type H Springs	Chain	Lumber	5/8 in. or over Rivets	Freight Labor
1895	0.03	0.03	0.05	0.035	0.05	0.025	0.10	0.20
1920	0.05	0.08	0.09	0.05	0.05	0.045	0.16	0.67*
1930	0.06	0.11	0.09	0.045	0.075	0.075	0.22	1.10
1941	0.065	0.075	0.10	0.055	0.08	0.06	0.22	1.40
1948	0.10	0.15	0.15	0.085	0.13	0.13	0.34	2.25
1950	0.11	0.185	0.175	0.095	0.155	0.13	0.42	2.80
1951	0.10	0.20	0.17	0.095	0.16	0.155	0.42	2.80

10 per cent added to net total bills for 1913.
* 30 per cent added to net total bills for 1919 and 1920.
Scrap credit per lb.—In the early years this varied from ½ to 1 cent for different materials, and since 1913 has been ½ cent for all materials except for brass and journal bearings.

TABLE II

Labor, Per Hour	August 1929	January, 1938	December 1941	February 1944	June 1946	September 1947	September 1949
Freight	1.10	1.25	1.40	1.60	1.95	2.25	2.80
Passenger	1.20	1.40	1.55	1.75	2.15	2.50	3.10
Tank	1.25	1.45	1.60	1.85	2.25	2.60	3.20
Lubrication and Cleaning	0.85	1.00	1.10	1.25	1.55	1.80	2.25

Items 107-C and 107-D—Modified to indicate that charge for complete geared hand brake or housing assembly includes upper chain. Billing repair cards, covering renewal of these parts need not show upper chain separately as was done in the past.

Item 132, Charges and Credits for D coupler parts—Table of average charges and credits for secondhand, reclaimed and defective parts eliminated and is placed on basis similar to *E* coupler parts, in conjunction with change made in Rule 104-a-2. Hereafter condition of each part removed must be shown on repair records same as is done with *E* coupler parts.

Item 172—Modified by omitting reference to side bearings in view of eliminating requirement in Rule 61-c on side bearings when lubricating center plates.

Item 213, Note 5—Modified to provide permanent basis for charge and credit for hangerless type brake beam other than the A.A.R. Standard No. 18 beam when renewed in kind, and lesser charge when substituted for A.A.R. No. 18 hangerless beam.

New Item 219—Added to provide for welded head and truss type of A.A.R. Standard No. 18 brake beam, Certificate No. 53, same also added to Fig. 2 Indentification table on page 213.

New Item 250—Added to Section I to provide charge for American Steel Foundries Quad draft gear which has been conditionally approved.

New Note 4—Added to Section I indicating 500 sets of Waughmat Twin Cushion Type WM-4-6 R draft gears have been authorized for experimental service. The *R* signifies used with rigid shank coupler versus swivel shank coupler used with their WM-4-6 gear which has been conditionally approved for unlimited application per Note 3.

Fig. 2, Brake Beams, page 213—Additional design of A.A.R. Standard brake beam added to cover Certificate No. 53 type.

A.A.R. Approved Equivalent Retainers, and Locks (Page 218)—"Twin-Lox" Draft Key Retainer is added, made by Western Railway Equipment Company.

A.A.R. Approved Types of Geared Hank Brake (Page 219)—Ajax No. 14370 and Union Asbestos and Rubber Co. No. 3750 have been added to table of *Vertical Wheel Type.*

A.A.R. Approved Types of Journal Box Lids (Page 220)—American Locomotive Company's "Alcolid" No. 560 and Union Spring & Manufacturing Company's No. 927 added to 5 by 9 5½ by 10 sizes; Gunite Foundries Corporation No. 493, Motor Wheel Corporation Nos. 171 and 173 added to 6 x 11 size list.

List of Approved Packing Retainer Devices (Page 221)—Added showing nine Spring Types and three Package Types.

General—This Rule has grown from 13 items in year 1885 to nearly 300 items plus tables of weights, sizes, etc., with combinations. The prices were rather frozen during the recent war, considerably increased since, mostly due to the large increase in labor costs. Similar occurred after World War I. Table I shows the changes in the principal items at seven stages since the year 1895.

Rule 104

Sections (a-1), (a-2), (a-3) and Interpretations No. 2 and No. 3—Modified account elimination of columns, "Charge Secondhand or Reclaimed" and "Average Credit (Secondhand, Defective or Missing)," opposite Items 132 to 132-E of Rule 101 Covering *D.* coupler parts and restoring these items to a regular charge and credit basis, similar to *E* coupler parts.

Rule 107

Labor Charges, Item 134 and 135—Modified to indicate that these items now include metal as well as good screws used in securing car parts. Table II shows the increases since the year 1929.

Rule 111

Air Brake Repairs, Items 15 and 15-A—Prices covering periodic cleaning of AB and AB-1-B air brakes are increased due to additional expense incurred in repairs and renewal of service portion back covers and 100 per cent renewal of emergency portion ball check covers, plus increased cost of other material.

Rule 112

Settlement for Destroyed and Badly Damaged Cars—Section B-1, New Fourth Note—Added to provide basis for settlement for caboose cars damaged or destroyed off home road.

Section J—Modified to include journal roller bearing assemblies as additional material which car owner may request return of under provisions of this rule.

PASSENGER CAR RULES

Rule 2

The effective dates of the following Sections have been extended to January 1, 1952:

Section (e)—Cardboards or suitable receptacles for Defect Cards and Joint Evidence Cards.

Section (f)—Brake shoe spark shields.

Rule 7

Section (c), Third paragraph—Incandescent fluorescent tubes or bulbs added as owners defects and eliminated from Rule 13. Labor charges provided by new Items 2 and 2-A added to P. C. Rule 21.

New Section (j-2) and Note—Added to provide that "When stenciling indicates air brakes are due for cleaning within 30 days, brakes may be cleaned regardless of whether or not car requires other repairs." This is to avoid rejection and setting out of loaded cars enroute due to old air date.

The New Note is to indicate that "all work should be properly performed as required by the applicable air brake instruction pamphlets."

Section (L-1 & 2)—Modified to provide that separate billing repair card is optional for periodic repacking of friction journal boxes and periodic lubrication of journal roller bearings to correspond with Freight Rule 9.

Paragraph (2)—Further modified to extend time limit to 90 days for grease lubrication types of journal roller bearings versus 30 days for oil lubricated types.

New Second Note—Added to table covering A.A.R. 1940-Design Passenger Car Axles Having Increased Diameter Wheel Seats, stating that table covering Alternate Standard tubular axle transferred to Freight Rule 86.

Rule 9

Section (g-2)—Fuel for internal combustion engines furnished at intermediate terminals added as a Line Service expense item.

Rule 13

Section (a)—Second item, Arch bars, straightened on car—Eliminated account obsolete.

Eighteenth item, Incandescent bulbs, applied—Eliminated account addition of new Items 2 and 2-A to Rule 21 permitting charge versus car owner for the application of incandescent and fluorescent types of bulbs and tubes used for electric lighting.

Rule 21

Labor Charges, New Items 2 and 2-A—Added as mentioned above.

Items 16, 20-C, 20-E, 20-F, 20-G, 20-H, 20-K and 20-M—Modified to provide increased labor and material allowances for the air brake work specified in each respective item, based on recent item studies by the A.A.R.

New Item 20-N—Added to provide charge for cleaning and repairing conductors valve which is chargeable to owner whether in connection with periodic attention to air brakes or separately.

Rule 22

Material charges—Adjusted in line with recent quotations resulting in considerable increase on most items. Where Stores Department cost is furnished, show the price, account and reference numbers on Repair Card.

Handling Prefabricated Freight-Car Sides

Assembly-line methods are not new in the construction of railroad box cars, but the Union Pacific recently inaugurated a materials-handling procedure which is greatly expediting the process. As a part of its current program to acquire 8,500 freight cars at a cost of $50,000,000

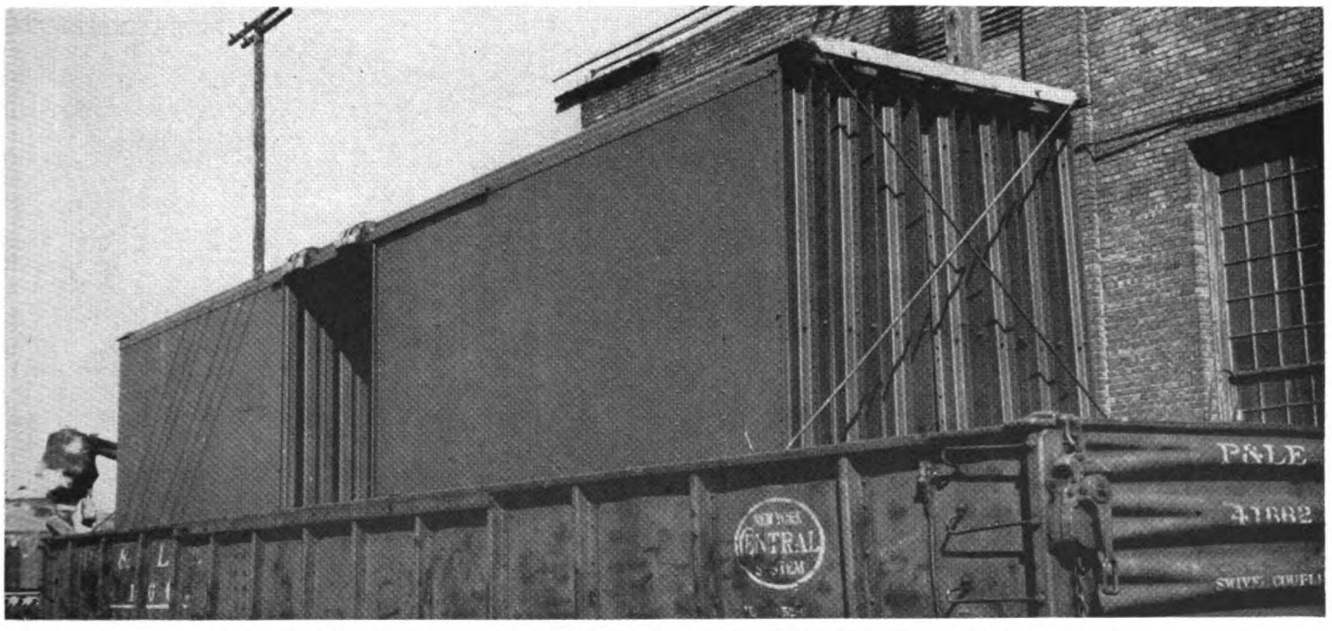


Fig. 1—How Youngstown steel box-car sides are received at Omaha shops, loaded in gondolas

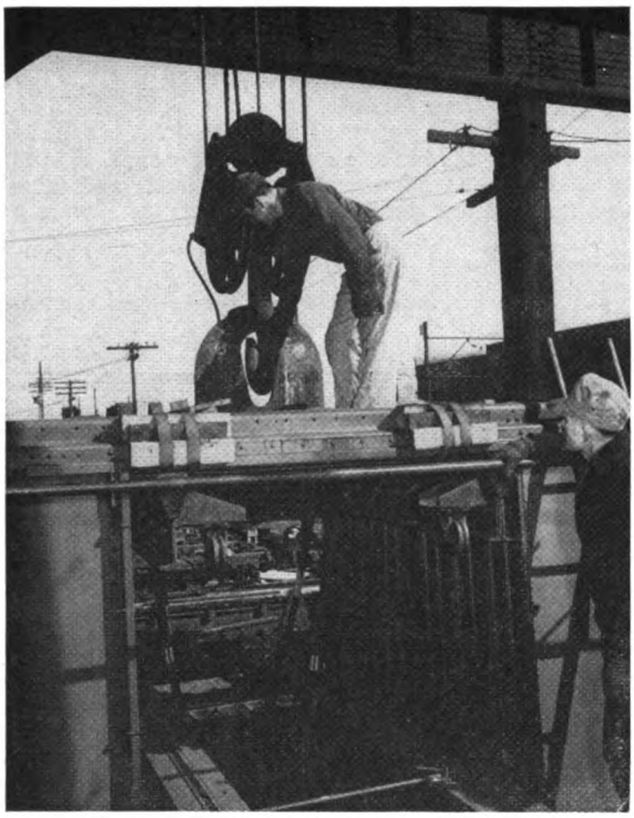


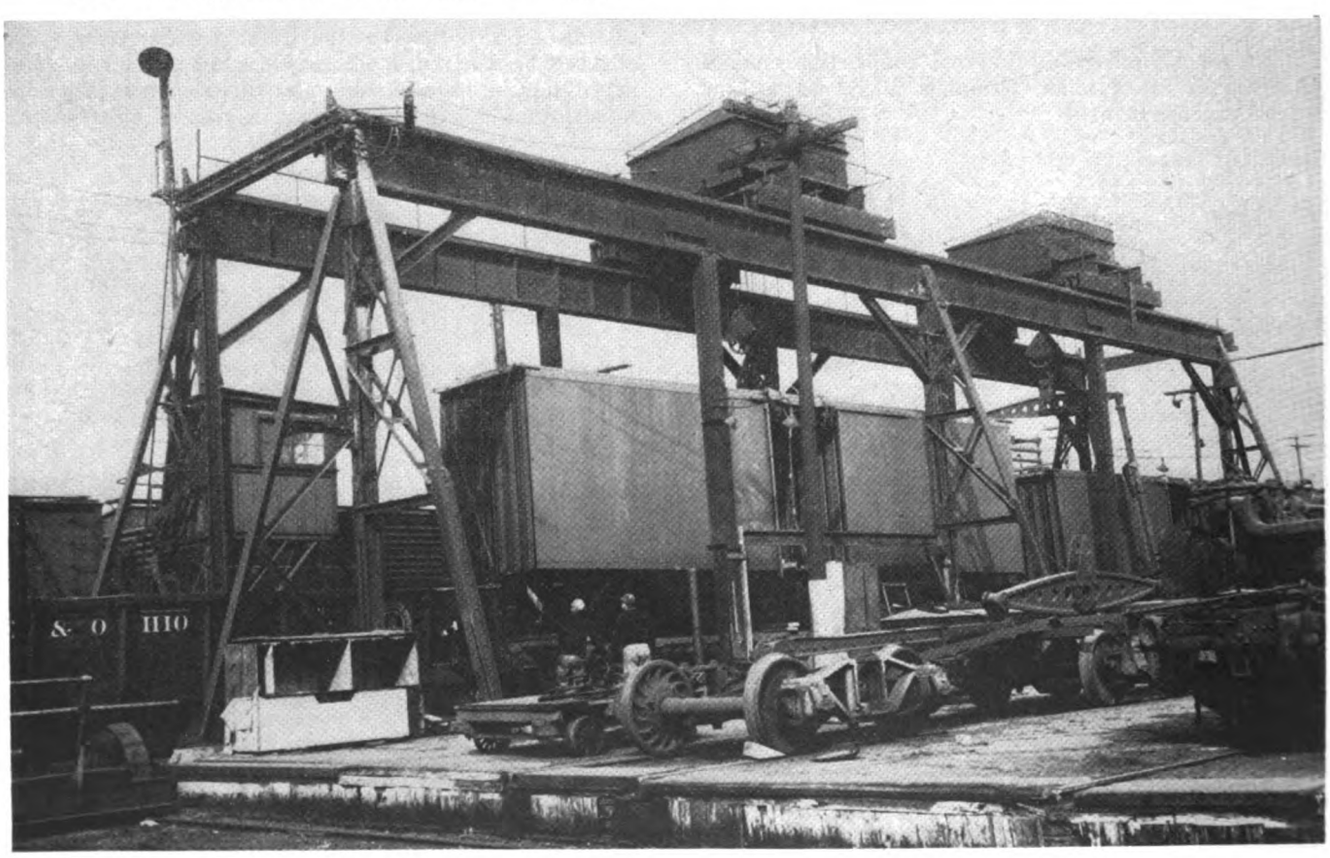
Fig. 2—Crane attachment used in unloading car sides from gondola in a single lift

the Union Pacific is building 1,000 box cars at the company shops, Omaha, Neb. Since car sides were arriving faster than other parts, necessitating double handling in unloading to stock piles and then moving to the construction track, the railroad worked out a unique system for eliminating ground storage.

Fig. 1 shows how gondola cars from the Youngstown Steel Door Company, Youngstown, Ohio, are each loaded with seven sets of box-car sides. The car is moved under a gantry crane flanked by a timber platform, and tie rods at the ends of the sides and tie bands through the doorways are cut away. A crane attachment is rolled through the doorway area of the sides and Fig. 2 shows how the crane hook is lowered to catch the eye of the attachment, which is raised midway between the sets of sides. Fig. 3 is an over-all view of the crane, showing the car sides suspended in the air. The gondola car, moved from under the load to the left, is free to go back into immediate service. Barely discernible under the suspended sides is an underframe, equipped with couplers and safety appliances, on trucks ready to accept the load. At the right, a second load of sides is waiting to move under the crane.

The car sides are thus carried on a long string of underframes with the sides cross braced at the ends and banded at doorways as in the original loads. When needed the loads are moved to the erection track where the sides are transferred to cars under construction. The Union Pacific is also building 500 40-ton livestock cars and 500 70-ton covered hopper cars and has completed 2,500 box cars and 500 livestock cars in its own shops. Five hundred flat cars are being built by the Union Pacific at Denver, and builders are constructing 1,000 gondola and 1,000 box cars and have already completed 1,000 gondola cars.

Fig. 3—Gantry crane transferring seven sets of car sides from gondola to truck-mounted underframe





A rehabilitated car. Side stakes were reused by plug welding to new sheets

How Ore Cars Were Reconditioned by Welding*

THE Great Northern has a fleet of 7,200 drop-bottom hopper cars assigned to iron ore service. These cars are of all-steel construction, 24 ft. long, with capacities of 75 tons and 1,200 cu. ft.

All repair work and reconditioning must be done in the winter in order that the maximum number of cars will be in serviceable condition during the 7- to 8-month ore season. Just before the close of the ore season, a thorough inspection is made of all ore cars and they are classified as to the type of repair required. Light repair work is done at the Allouez repair yard, and the heavy repair and rebuilding at the Superior steel shops. The cars were originally purchased from a car builder and for the most part are of riveted construction.

Last year it was decided that 400 of the older cars built in 1920-24 were to be reconditioned, and instead of the riveted type construction, an all-welded type construction would be used for new baskets or hoppers. The reason for this change was that a saving could be made in labor and material. For instance, by making new baskets by welding, 400 5/8-in. rivets per car would be eliminated. The baskets would be more efficient, too. Welded construction of the basket would eliminate ore sticking to rivet heads, and cars would empty more easily and competely.

The old baskets were stripped from the underframes, then the underframes and trucks were repaired outside the shop. All of the new basket prefabrication and assembly work was done inside the shop, which measures 108 by 240 ft. Crane facilities in the shop are not unusual and other equipment consists of a press brake, used to form end and side slope sheets, a gang punch shears, stationary and portable flame-cutting machines, three automatic submerged melt welding heads, three flexible welders of the submerged type, and ten electric welding machines. More of the latter are brought in as needed.

Each car received a complete new welded hopper or what we call a basket. Trucks and underframes were in good condition and in practically all cases it was cheaper to repair them than to buy new equipment. By utilizing various jigs and devices, and assembly-line methods, eight cars per eight-hour day were reconditioned and ready for service. Most of the illustrations for this paper show the repairs on an order of 70 ore cars. This repair work varied slightly from the repairs made to 330 cars done earlier.

Fig. 1 shows a car ready for removal of the old riveted basket. All rivets were removed by flame-cutting. Side

* Abstract of an address delivered before the American Welding Society by J. F. Likarish, master car builder, Great Northern

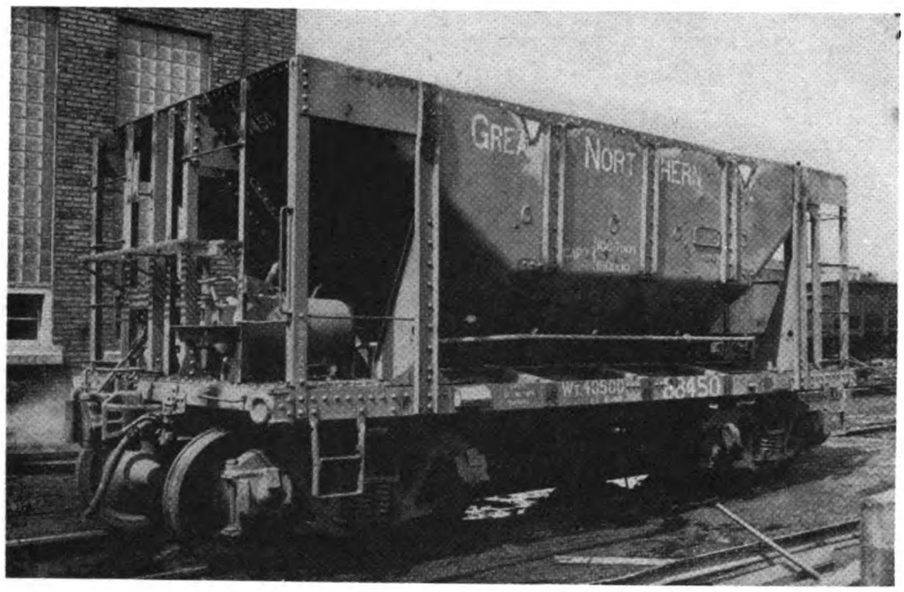
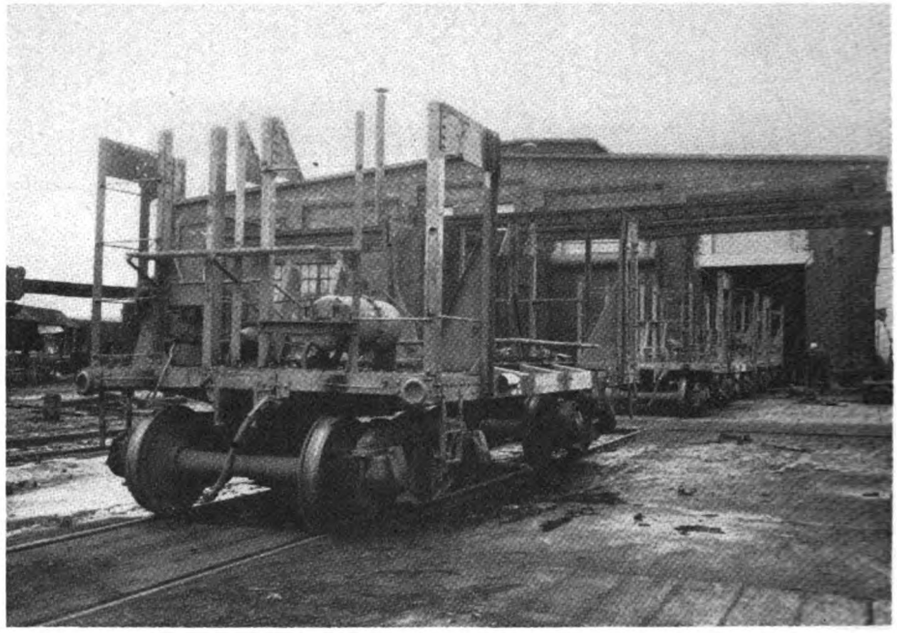


Fig. 1—Car ready for removing the old riveted basket. The two large triangular holes near the top of the side were flame-cut to facilitate lifting the basket with an overhead crane

Fig. 2—Repaired underframes heading into the shop for application of new baskets



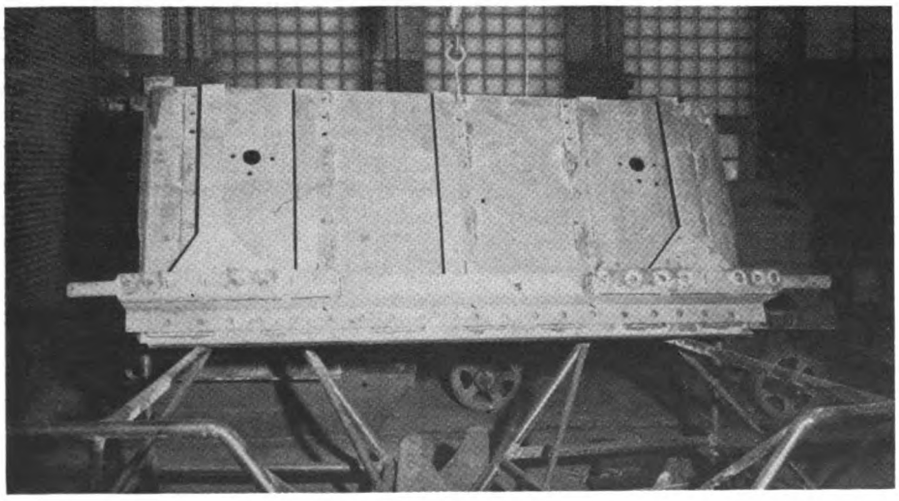


Fig. 3—Hopper bottom door reconditioned by intermittent hand-arc fillet welds with plug welding

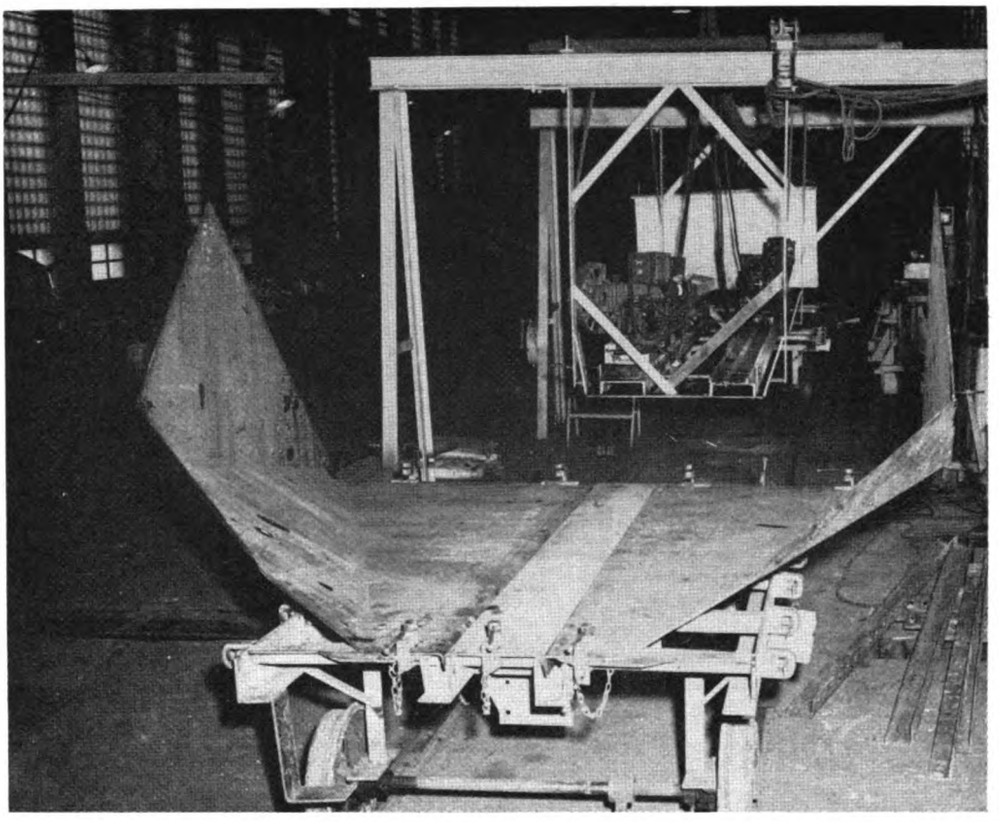
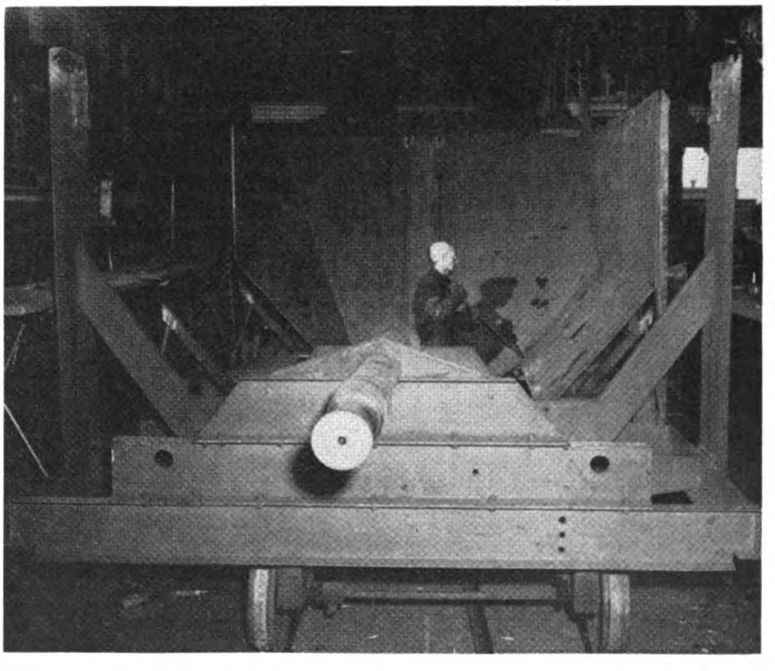


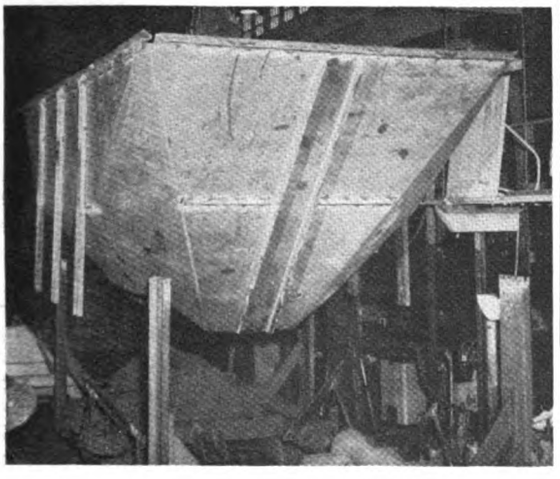
Fig. 4—How the end slope sheet is assembled preparatory to joining by the submerged welding heads in the background ➔



➔ Welding a stiffener angle to the nearly completed end slope sheet

➔ Two basket jigs are used for positioning, and two are used at the welding stations





➔ The nearly completed basket being removed from its jig



Welding the new side stakes to the side slope sheets by manual arc welding

and end top angles have been removed. These will be straightened and welded to any car of this type which is going through the reconditioning. Holes are flame-cut near the top of the basket by which an overhead crane with a four-hook sling lifts out the basket. Steam hole or poke hole covers are removed and re-used on new baskets.

Fig. 2 shows three repaired underframes headed into the shop door. Just inside the shop the new basket will be lowered into place to start the re-assembly. The couplers and draft gears have been removed and after close inspection they will be repaired or replaced by new units if found to be defective.

Sub-Assembly Fabrication

The next steps described will be in the fabrication of sub-assemblies for the new all-welded baskets. An automatic flame-cutting machine used in this program cuts eleven sheets of copper-bearing mild steel ¼ in. by 104 in. by 120-in. at the rate of 7½ in. per min. A No. 8 cutting nozzle is used. Oxgyen pressure is 42 psi.; acetylene, 3 psi. The operator uses a crowbar to force the sheets together as the cut progresses. Strong backs used to clamp the plates have built-in slots into which the crowbar fits easily. One operator using this machine cuts eight sets of car end and side sheets in eight hours.

Fig. 3 shows a reconditioned hopper bottom door. A Z-bar support from an old door is welded to the new door plate that is cut to size and pressed-formed. Old Z-bars were straightened in a shop-made press at a special station equipped for that work. In the 330-car order, the construction of the door made it possible to use semiautomatic submerged melt plug welds between the reinforcements and the door sheets. There were 41 plug welds per door. In door repairs as shown here, intermittent hand-arc fillet welds were used in the construction with some plug welding.

Fig. 9 shows the station where new side stakes were welded to side slope sheets by manual arc welding. A 500-amp. machine with a 3/16-in. coated rod was used for this operation.

In assembling parts of end slope sheets, a small formed channel at the center of the jig is welded to the two large sheets. The top angle is also a part of this assembly. Hinged C-clamps hold the parts on this rolling jig, and six telescope bars can be wedged to hold the sheets together during welding.

Fig. 4 illustrates the end slope sheet jig and shows how the end slope sheet is assembled, ready to roll under the submerged-arc welding heads in the background. Four of these portable jigs are used.

The flange joint to be welded between the end and channel or middle section of the slope sheet is filled in with a ¼-in. soft steel rod tack welded at one end into the base of the root flange-weld that is made by submerged melt welding. A small concave wheel rides on the rod, guides the machine and, at the same time, holds the rod down in the groove. The purpose of this soft steel rod is to shorten the welding time.

Two U-type welding heads simultaneously make the root flange welds in the end slope sheets. Each weld is 9 ft. long and made at 14 in. per minute; a.c. voltage is used. The current is 650 amp., and the rod is 3/16 in., Type No. 36. The melt is designated as No. 80, 20 by 200 mesh. A jig cart positions the part under the welding head.

Fig. 6 shows the nearly completed end slope sheet to which one of two stiffener angles is being arc welded. Note the top end angle in place. This particular type of end angle construction made it necessary to fillet weld the angle to the sheet by the hand-arc method. The construction of the cars in the 330-car order made it possible to use automatic welding of the end top angle without removal of the assembly from this jig. This was done by swinging a track and welding head over the assembly in this welding line.

Final Assembly Operations

A carman is positioning one of the side slope sheets in the basket jig shown in Fig. 7. Four of these jigs were used in this program. While two are used for positioning, the other two are used at the welding stations. Note the side stake on the near edge of the side slope. The end slope sheet will be placed in the jig at the end nearest the camera. The side stake will overlap the butt joint of the side slope sheets.

When the dollies are removed from each end of the jig in Fig. 7 it can be turned 360 deg. and held in four different welding positions. A flexible semiautomatic welding head is used for the welding.

A flexible welder is employed to make intermittent welds between the top angle and the side and end slope sheets. Current is 350 amp., 30 volts, while the rod is 3/32 in. Speed is 12 to 14 in. per min., with full penetration. The flexible welder also makes the butt weld between end and side slope sheets. This welding method was also used to make two plug welds at the top of the side sheets, the weld going through to the side stakes, makes a total of eight plug welds per car.

A copper back-up bar is used on the outside of the basket at the butt joint between the end and the side slope sheets below the side stakes.

In the 330-car order previously mentioned it was possible to use the old car side stakes on new baskets. In preparation for their re-use, rivets were removed by flame-cutting and through the rivet holes plug welds were made to the sheets at the welding station shown here. An elevator device is used to bring the rod and melt feed machine to the level to make this plug weld possible. At

this station also, the butt-welding inside the basket was done with the welding machine at the lower position. In other words, the welder was used at the upper position for plug welds and at the lower for butt welding. There were 106 plug welds per car on the 330-car order just mentioned. As shown in a previous photo, side stakes were manually arc welded in the 70-car order, pictures of which are shown in this paper. Fig. 8 shows the almost completed basket being lifted from one of the jigs. It will be moved by crane down the shop and placed in a reconditioned underframe.

A view of the inside finished basket would show the few rivets used in these rebuilt cars—on the corner angles, safety appliances and doors. While rivets are not desirable in the doors, they were used because the hinges were malleable iron and in too good a condition to scrap.

Following the assembly of the basket to the underframe the air line pipes were renewed, the hand brankes were reconditioned and tested, and the door closing mechanisms were installed and tested.

Fig. 1 is a completed rehabilitated car. You will immediately notice the construction differences between this and the one first shown. The car here is one of the 330-car order in which the side stakes were re-used by plug welds to the new side sheets. In this type of car the top angle is on the inside of the slope sheets.

Welded construction of the new baskets has given a car that will provide service equal to that of a new car. The rehabilitation has resulted in a substantial saving to the Great Northern.

Reclaiming Car Couplers

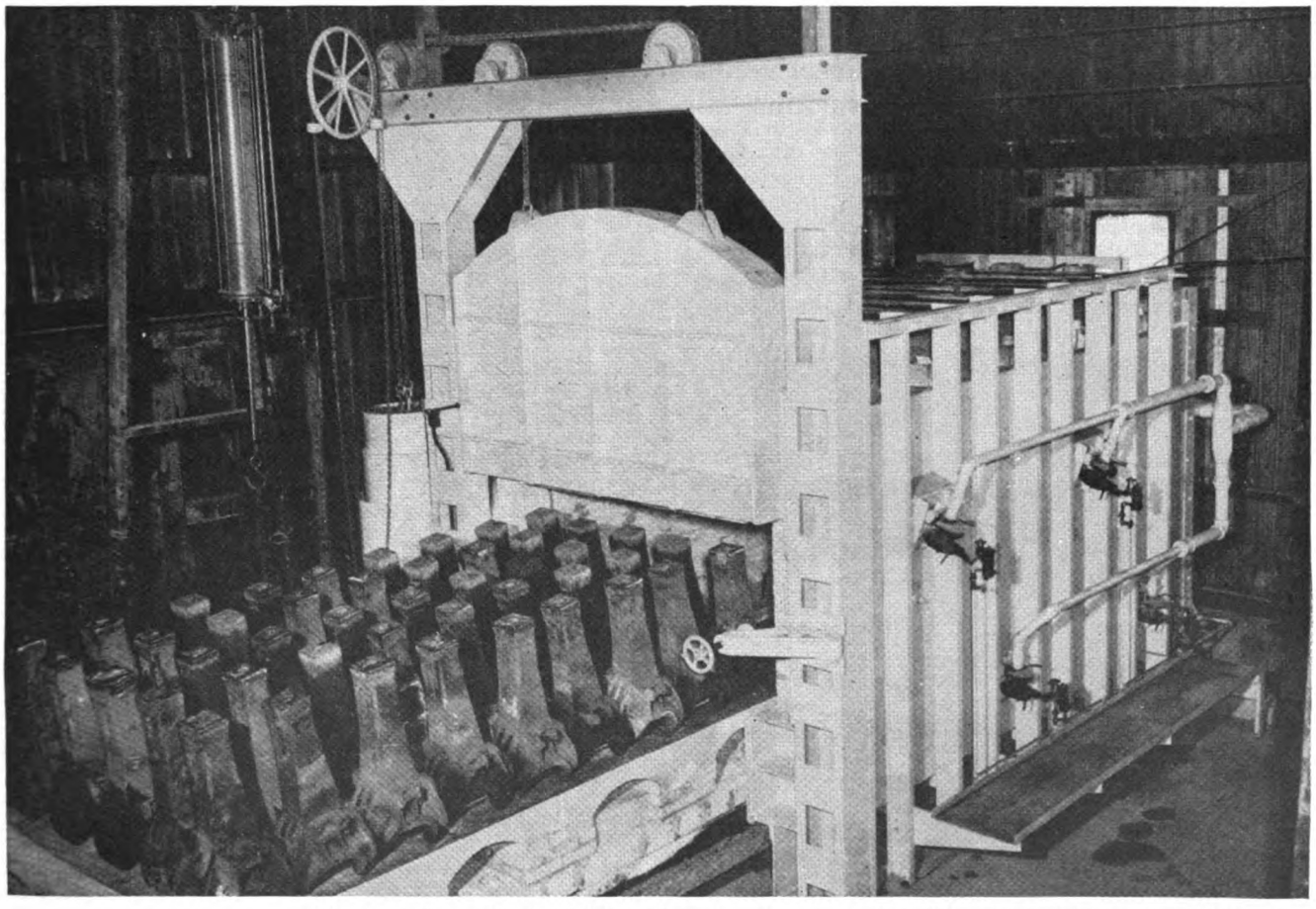
More than 300 damaged cast steel car couplers averaging 280 lb. each are being reclaimed each month by the Erie at Meadville, Pa., and put back into service conserving 87,000 lb. of metal, through a new welding and normalizing process undertaken after exhaustive research and tests. The process has been approved by the A. A. R. Mechanical Division.

After welding, the couplers are normalized in a new automatic heat-controlled furnace, which makes the reclaimed material suitable for continued use. The furnace is of the car type 6 ft. 6 in. wide by 12 ft. long, with a door 3 ft. 6 in. high and heated by 8 oil burners.

Forty-five welded couplers stand vertically on the floor and fill the oven. A low heat is applied and brought up gradually to 1,600 deg. F. taking two hours to reach that temperature. A pyrometer holds the heat at 1,500-1,600 degrees for one hour 45 min., before it is shut off and the couplers drawn and allowed to cool in still air free from drafts, snow or rain.

Normalizing couplers relieves heat stresses, corrects fatigue and crystallization and gives them new life so that they stand as rigid tests as new units. Processed couplers are applied to foreign cars in routine manner.

Erie car inspectors find about 370 damaged units monthly and send them to the Meadville plant for reclamation. After examination about 80 per cent are saved, welded and normalized, and the others scrapped or converted to other uses.



The second step in the Erie's reclamation of car couplers. After being built up by welding, the couplers are placed 45 at a time in the furnace for annealing at 1,500-1,600 degrees for 1¾ hr.

ELECTRICAL SECTION



Fig. 1—A general view of the Northfield car showing the packaged diesel-driven, a.c. power plant (see Fig. 5) and the condenser and radiator package unit (See Fig. 2)

A. C. Power Plants for Passenger Cars

Westinghouse undercar diesel generating plant with twin sealed compressors to be tried out under various climatic conditions by the Rock Island

*By H. H. Hanft and I. S. Ritter**

A TRIAL installation of Westinghouse a.c. passenger car power was made late in 1948 on the car "Northfield", of the Chicago, Rock Island and Pacific. The car was first put in service between Chicago and Des Moines, Iowa, on the "Des Moines Rocket". To obtain information on a north-south run, with its extremes in temperature, the car was transferred to the "Twin Star Rocket" running between Minneapolis, Minn., and Houston, Tex., in February 1949. It remained in this service regularly until November 1949, when it went into its present run between Denver, Colo. and Chicago on the "Rocky Mountain Rocket".

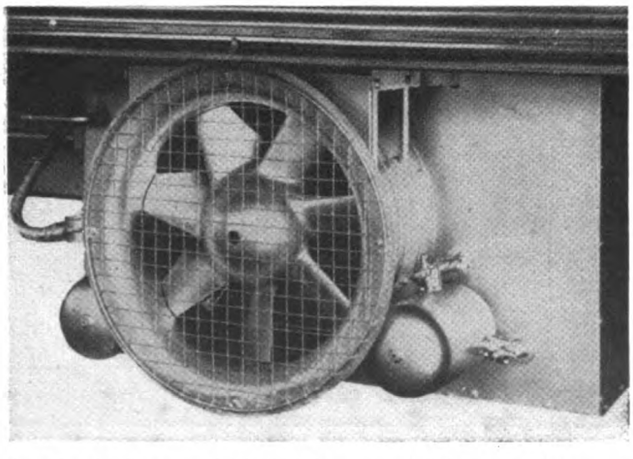


Fig. 2—A close-up of the condenser and radiator package unit

The Power-Plant Package

The power-plant package, resiliently mounted under the car, includes a diesel engine and an alternator. The complete removable power plant weighs 3,000 lb. The engine used is a Type DJXHF Hercules diesel engine. This is a horizontal engine specially developed to meet the exacting clearances required on undercar railroad equipment. It is a 6-cylinder unit with 209 cu. in. displacement and a rating of 79 hp. at 1,800 r.p.m. at sea-level altitude and normal temperature. When the engine is derated for altitude and temperature, the engine is rated at a little more than 2 hp. per kw. of generator rating. Opera-

* H. H. Hanft, Transportation Section, Westinghouse Electric Corporation, East Pittsburgh, Pa., and I. S. Ritter, Sturtevant Division, Westinghouse Electric Corporation, Hyde Park, Mass.

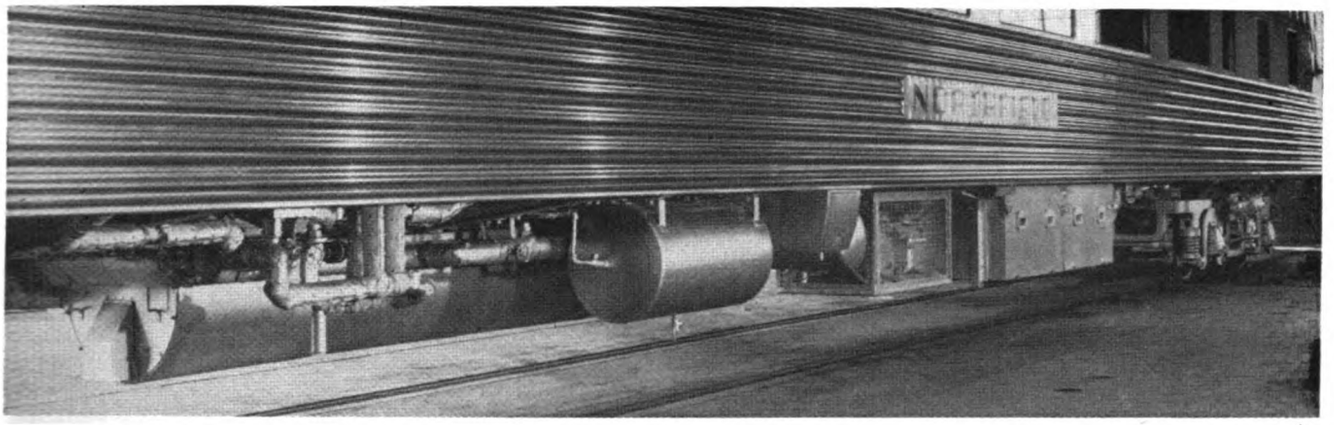
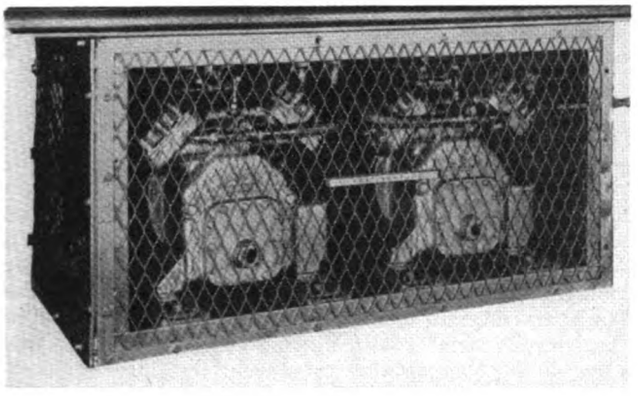


Fig. 3—A view of the other side of the Northfield car shows the hermetically sealed air-conditioning compressor mounted underneath (see Fig. 4)

tion of the engine at light loading tends to reduce maintenance requirements and costs, and still keeps the engine in a loading range for economical operation.

Coupled directly to the engine is a Westinghouse 3-phase alternator. It delivers 30 kva. at 0.8 power factor, 220 volts and 60 cycles. The excitation system has no moving parts, which saves a great deal on service work and gives regulation. The rotating main field is excited through the car emergency-lighting battery. The second or auxiliary field is excited to maintain constant voltage at varying generator loads. It is connected across a selenium rectifier that is served by three current transformers in the main-generator leads. Any increase in generator load increases current in the rectifier thus increasing the field current to maintain a constant voltage. Response to load changes is extremely rapid, as no inertia of moving parts is involved. Close regulation is obtained.



The engine and alternator are packaged so that all routine servicing of the engine can be accomplished without moving it. Lubricating-oil filters, fuel filters, air cleaner, lubricating-oil drains, and filler pipe are all located at the front of the unit. When necessary for other servicing or to replace the power plant with a spare, the entire unit is rolled out on slide rails after disconnecting sealed water and fuel couplings and electrical plugs. Removal and replacement of a power plant has been accomplished in five minutes.

To furnish the engine with as clean combustion air as possible, 250 cu. ft. per min. of conditioned air is drawn

Fig. 4—(above) A close-up of the hermetically sealed air-conditioning compressor, also a packaged unit

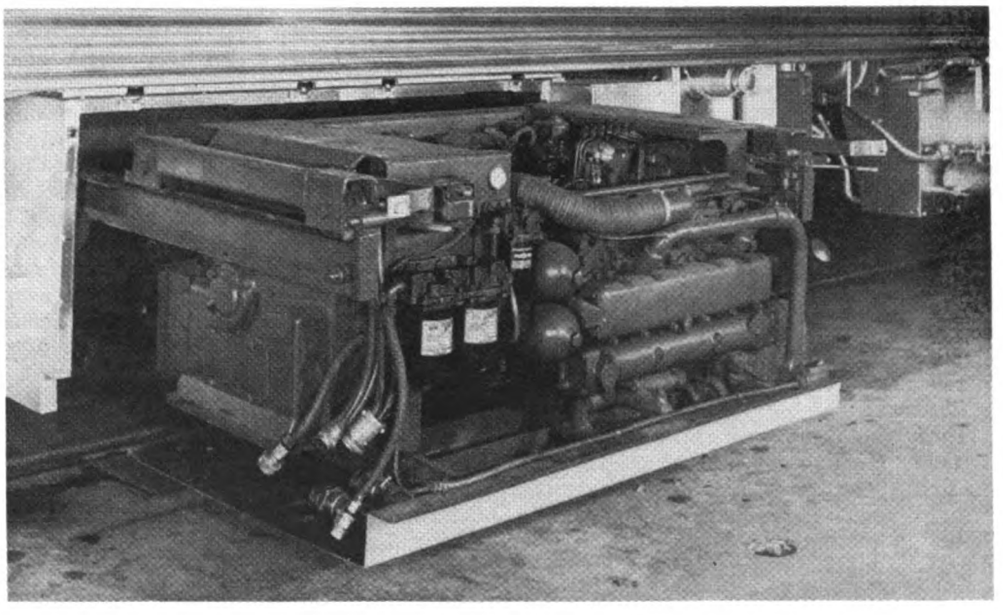


Fig. 5 — The packaged diesel-driven, a.c. power plant rolled out on slide rails for inspection

from within the car. This air first passes through the generator and then divides. Part goes to the engine air intake through its air filter. The remainder spills into the power-plant package, building up a slight pressure which helps keep dirt out. This clean air serves to reduce maintenance and insures against engine damage should the engine air filter not be properly maintained.

To facilitate starting in cold weather a loop is connected to the train steam line and run through the power-plant package. When out door temperature drops to 40 deg. F. and the engine is shut down, steam is supplied to the loop keeping the engine warm.

During a typical period, which covers both winter and summer operation, the average loading of the unit was 13.7 hw.-hr. The fuel consumption was 6.73 kw.-hr. per gal. of fuel oil and 72.8 kw.-hr. per quart of lubricating oil.

Air-Conditioning System

The air-conditioning system is designed to use two standard Westinghouse hermetically-sealed compressors. Each compressor is driven by a 5-hp., 3-phase, 60-cycle, 220-volt, 1,750-r.p.m. motor built integrally with the compressor. Freon-12 refrigerant vapor passes over the motor windings to cool the motor. The compressors are connected to two entirely separate systems and have a total cooling capacity of from 8 to 9 tons.

The outstanding advantage of the two separate systems over the single-compressor system is the fact that one system can ordinarily carry the car load. The second unit is required on only a few high-temperature days, or in case of a break-down of one compressor or should a leak develop in one system. In the single-compressor system, a failure of this type would mean a hot car for the remainder of the run, which might be as much as 60 hours.

For ease in servicing—a matter of great importance in railroad service—each compressor is also mounted in a package on movable slides. Lines to each are sealed by a set of valves while the compressor itself is sealed by another set. Closing these valves and unbolting two flanges allows the compressor to be removed and another fully charged one slid into its place. The compressor-package, like the engine-generator package, is an under-car installation.

The method of controlling the air-conditioning system provides the railroad passenger with exceptional comfort. The essential difference is the removal of moisture from the car air when the outdoor temperature range is between 60 and 75 deg. F. and then reheating it to the desired car temperature. One compressor system is controlled only by outdoor temperature and operates continuously when the temperature is 60 deg. F. or above. At this point, car cooling is not needed but the evaporator removes moisture from the air as well as cooling it. This moisture is removed in sufficient quantity to insure a satisfactory effective temperature without dependence on a humidistat. Humidistats in general are erratic. After some moisture has been removed, the air is reheated electrically to maintain the car temperature at 75 deg. F.

The second compressor and its system is controlled only by the temperature within the car. It operates only when the first system is not able to keep the car down to 75 deg. F. or at any time when the car temperature is above its 75-deg. F. setting. In this manner, car conditions of 75 deg. F. and below 55 per cent relative humidity are maintained under all warm-weather conditions.

Future installations of this system will provide for the use of the engine waste heat in heating the car, thus making the car completely independent of the locomotive for heating, cooling, and power. This was purposely not done with this experimental installation to simplify the gathering of performance data. With this additional utilization of equipment, part of the 55 to 65 per cent loss in heat energy from the fuel will be utilized, making an extremely efficient system. It is expected that when complete trains are equipped with this system that operation in multiple will be desired.

The Air-Conditioning Condenser

The condenser is air cooled, aided by atomizing sprays of water controlled by discharge pressure. The condenser can carry an 8-ton load, without any water, until the outdoor temperature exceeds 90 deg. F. If the temperature is above 90 deg. F., the discharge from the compressor in service rises sufficiently to bring the sprays into operation. Each compressor has its own condensing coil and sub-cooling coil. The condensing coils and sub-cooling coils are built into one assembly and receive their cooling air from one Axi-Flow fan. Liquid receivers for the two systems are also mounted on the package.

To save duplication in parts such as motor, fan, and casing, the engine radiator coil is mounted in front of the condenser coil as part of the condenser package, using the condenser fan and housing. This method also insures that a separate radiator cannot be located under the car so as to blow hot air over the condenser coil, which would reduce its capacity.

The mounting of the radiator coil to the condenser poses a problem in winter. It is necessary to operate the fan at all times for engine cooling, but during the winter with the condenser not operating, snow could block the condenser coil and prevent air from reaching the radiator. By automatically reversing the rotation of the motor-driven fan, when the outdoor temperature drops to 40 deg., the air is then brought in through the hot radiator coil, which insures against coil blockage. At 60 deg. the fan again reverses to its normal rotation. Any water in the spray system is also automatically dumped at this same 40-deg. temperature to prevent freezing.

The Air-Conditioning Evaporator

The system evaporator is an overhead type located in the roof of the car. The evaporator is made up as a packaged unit, which includes its two separate system coils, a fan section, an emergency steam coil and a bank of electric strip heaters for use on reheat and car heating. Two single-inlet Multivane fans supply air to the evaporator. The air is made up of 1,600 cu, ft. per min. of recirculated air and 800 cu. ft. per min. of outdoor air. The evaporator coil for each system covers the full face of the package so that all air must pass over a refrigerated surface, even with one compressor shut down. On the leaving end of the evaporator is mounted an 18-kw. bank of electric strip heaters that are used to reheat air leaving the evaporator after dehumidification and for car heating in cold weather.

The Control System

A novel and effective method is used in controlling the overhead bank of electric heaters. Three 7½-kva. saturable-core reactors control the power input to the heaters. The a.c. coil of each reactor is placed in a leg of the 3-phase circuit. The current in the heater circuit is then

(Continued on page 81)



General view of interior of original building now devoted to mileage overhaul and assembly of motors and generators

The Southern's Diesel Electrical Repair Shop

An explanation of the requirements of a diesel locomotive electric shop and a description of the facilities installed to meet those requirements

Part I

By R. H. Herman *

COMPLETE new facilities for the repair and overhaul of diesel-electric locomotive traction motors main generators and auxiliary generators were placed in service at the Southern's Pegram Shop, Atlanta, Ga., in 1944. Since that time, additional tools and equipment have been purchased and the shop expanded until it now occupies over twice as much floor space as in the original layout. This expansion was essential to take care of the increased volume of work as additional diesel-electric locomotives were placed in service on the system lines.

The shop in its present state represents a large amount of preliminary work in both planning and estimating cost and operating data, as well as visits to the relatively few repair shops which were in operation at that time for repair and overhaul of diesel-electric locomotive traction motor and generator equipment. Subsequent developments

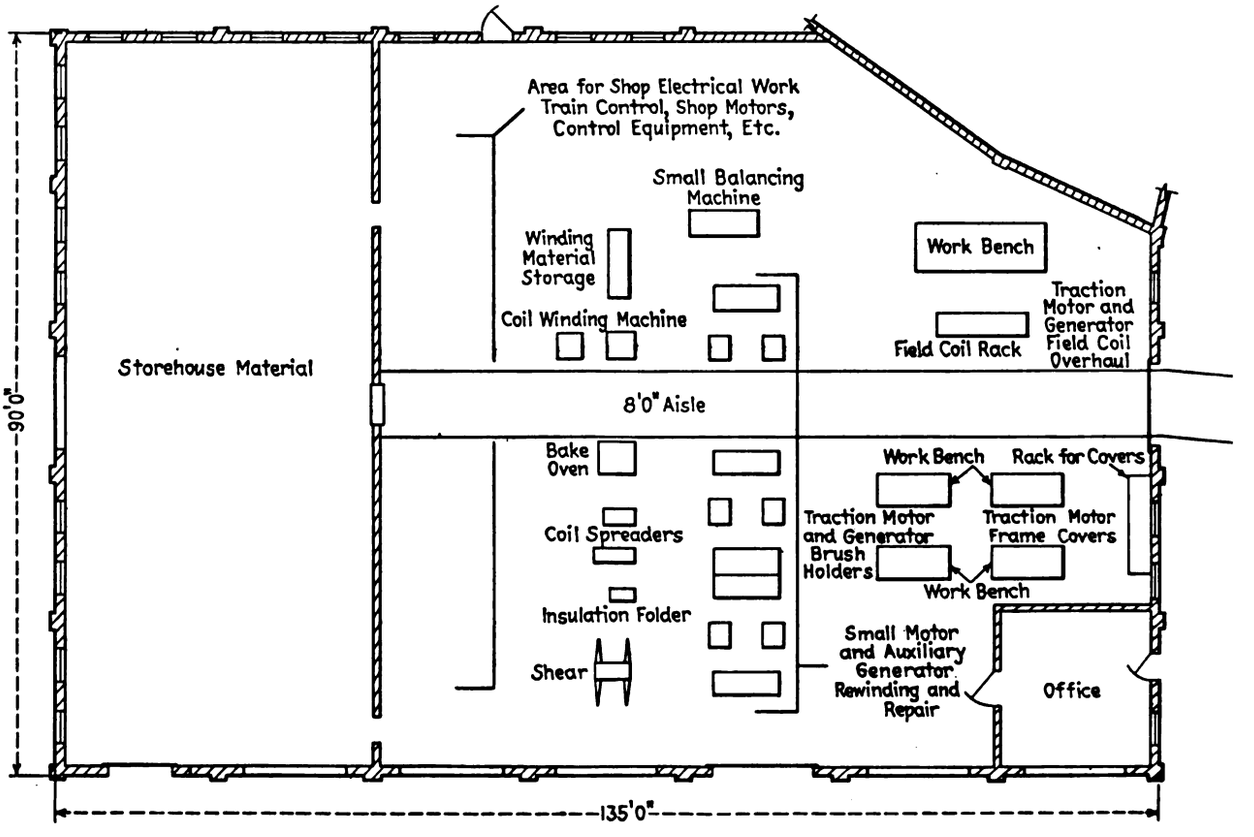
* Engineer, Shops and Equipment, Southern Railway System, Washington, D. C.

have proven the value of the preliminary studies, since it has been relatively easy to expand the facilities as necessary for the increasing volume of work. The following data illustrates the manner in which maintenance requirements have grown, and the steps which were taken to satisfactorily handle the requirements. As such it should provide a guide in planning similar facilities on railroads anticipating large scale dieselization in the future.

The first diesel-electric locomotives on the Southern were six diesel-electric rail cars which were purchased and placed in service late in 1939. A short time later, the diesel-electric freight locomotive was introduced by Electro-Motive Division of General Motors Corporation, and trial operation of this equipment during the latter part of 1940 soon resulted in orders being placed for a number of freight units, followed by orders for passenger and switcher locomotives.

In January, 1942, the locomotives in service comprised the six rail cars mentioned above, fifteen 2,000-hp. passenger units, eight 1,350-hp. freight units and thirty-three 600- or 1,000-hp. switchers, making a total of 62 units. In addition, there were sixteen 1,350-hp. freight units and one 1,000-hp. switcher on order for a total of 79 units. Indications were that additional diesel-electric locomotives would be purchased as financial conditions permitted. However, it was inconceivable that in a short space of ten years they might replace practically all existing steam locomotive units and become the basic motive power for freight, passenger and switching service.

Traction motors and generators on the first locomotives which failed within the warranty period, or were removed for mileage overhaul, were returned to the manufacturer in the case of Electro-Motive Division, or overhauled by local service shops of the General Electric Company and Westinghouse Electric Corporation. The manufacturers' repair procedure at that time was primarily on a unit exchange basis, and there was some concern over the sending out of relatively new motors and receiving in return older motors which might have considerably less winding life. It is true that over a period of time, this factor would average out, but it does work to the disadvantage of the railroad having relatively new locomotive equipment. Consequently, it was felt that a railroad-owned and operated shop would be desirable, if the cost of construction could be justified.



Electrical equipment from Southern shops, such as those at New Orleans, Atlanta, Jacksonville, Memphis, etc., had to be shipped to Chicago, which involved off-line, as well as on-line haulage, and considerable time was lost in transit. Motors which were sent to local service shops did not receive a fully adequate overhaul, since very few of these shops were equipped with vacuum impregnators and balancing equipment to perform the work in accordance with manufacturers' specifications. The billing costs were also high, due to the small volume of work and the expensive equipment required in the repair shop.

It should be noted here that all the electrical manufacturers have now built new service and repair shops in strategic locations or have equipped existing shops with the necessary equipment to perform this work on a production basis. Repair costs have also been reduced materially.

Careful consideration was given to determine the best location for a system traction motor and generator re-

pair shop and the choice was soon narrowed down to a location near existing shops at Chattanooga, Tenn., and Atlanta, Ga. Both of these cities are near the geographical center of the system, and the length of average haul would be almost a minimum. There were no suitable buildings at either point which could be released from service or converted for repair shop purposes. The facilities at Chattanooga comprised a roundhouse and machine shop which were utilized at that time for steam locomotive work. Even if a new building were constructed to serve the needs at that time, there would have been no space available for future expansion.

Facilities at Atlanta, however, included a locomotive heavy repair shop with a number of buildings which might be released from steam locomotive work in the future. While it would be necessary to construct a new building at the start, it was evident that a large amount of building space would be available for expansion when a greater number of diesel-electric locomotives were placed in service. In fact, the entire shop has now been converted for diesel-electric locomotive repair work. Inspection pits and platforms have been installed in a portion of the erecting and machine shop bays for progressive maintenance while the balance of the shop is devoted to diesel heavy repair work.

It was finally decided to locate the proposed repair shop at Atlanta and detailed estimates were prepared to cover the construction of a new building with necessary machinery and equipment. Authority forms were prepared and approved by the management for a total expenditure of $150,000. It was estimated that a saving of $30,000 per year could be realized, based upon overhauling 25 motors per month, with a saving in labor, freight charges, etc., of $100 per motor.

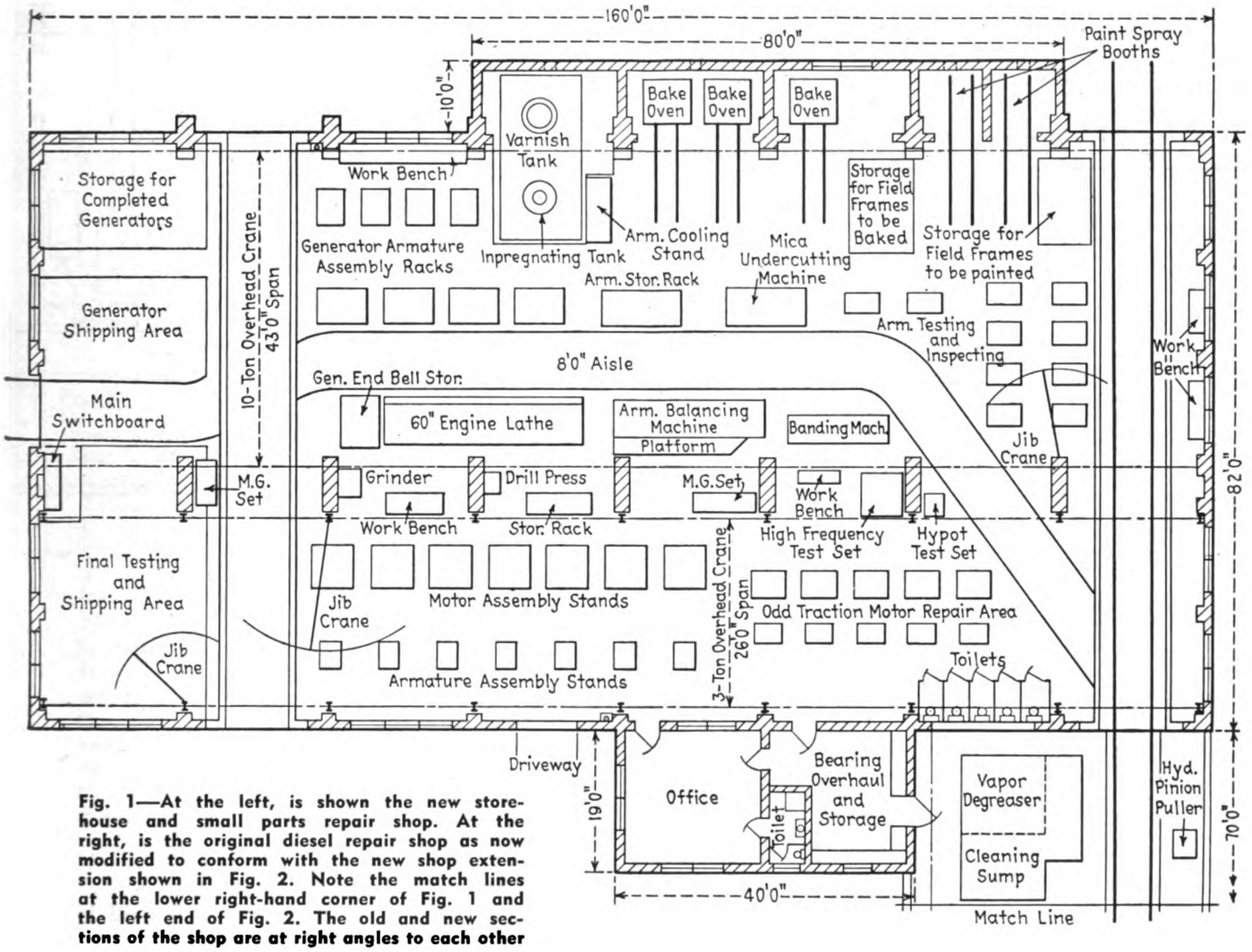
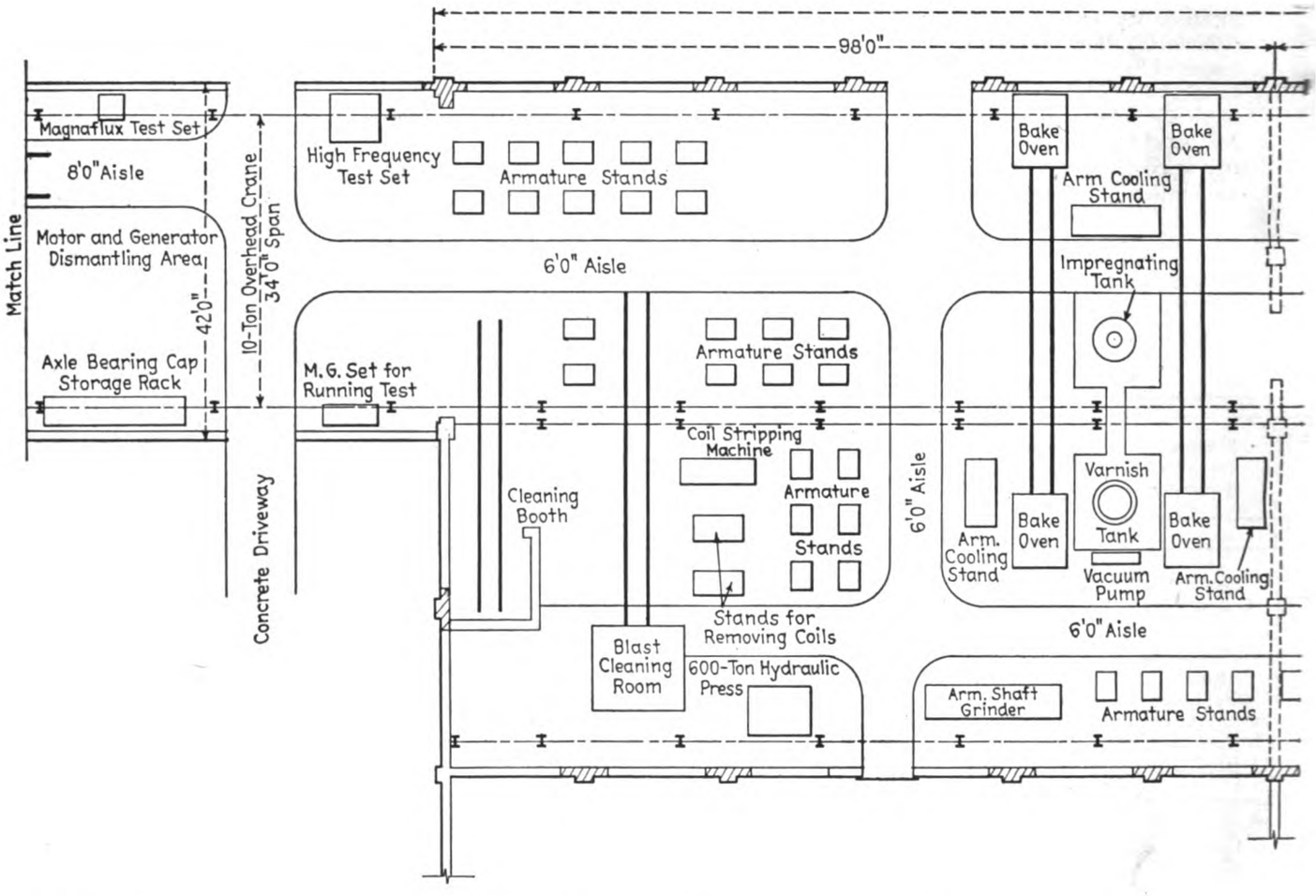


Fig. 1—At the left, is shown the new storehouse and small parts repair shop. At the right, is the original diesel repair shop as now modified to conform with the new shop extension shown in Fig. 2. Note the match lines at the lower right-hand corner of Fig. 1 and the left end of Fig. 2. The old and new sections of the shop are at right angles to each other

The original installation covered a new brick building 82 ft. wide, by 162 ft. long, with two longitudinal bays, and an addition on one side, 19 ft. wide by 40 ft. long, housing office and tool room, and an addition on the other side, 10 ft. wide by 80 ft. long, housing various items of equipment. The high bay provided a clearance of 30 ft. from bottom of roof truss to floor and was equipped with a 10-ton overhead traveling crane. The low bay has a height of 20 ft. from the floor, and was provided with 1- or 2-ton electric hoists on jib cranes for handling parts.

The following equipment and machinery was included in the original installation:

1 Gisholt Type 6U Dynetric balancing machine.
1 10-ton overhead traveling crane.



1 Vacuum impregnating unit consisting of one each, impregnating and varnish tanks, 60-in. diameter, 60 in. deep, a surface condenser, and a motor-driven dry vacuum pump; manufactured by J. P. Devine Manufacturing Company.

1 Compartment car type armature baking over, 5 ft. 6 in. wide by 6 ft. deep by 7 ft. 4 in. high, arranged for electric heat, as built by Young Brothers Company.

1 Cincinnati double-end pedestal grinder for 3 in. by 18 in. by 1½ in. wheels with 5 hp. a.c. motor.

1 Cincinnati double-end bench grinder for 1½ in. by 10 in. wheels with 1-hp. a.c. motor.

1 300-amp. portable welding machine.

1 Electric Service Supplies Company heavy duty armature machine for banding armatures and grinding, turning and undercutting commutators.

3 2-ton electric hoists.

2 1-ton electric hoists.

1 3-kva. hypot testing machine, 0-3,000 volts secondary, 115 volts, single-phase, 60 cycle primary.

1 N. A. Strand & Co. Type M-7 flexible shaft grinder.

1 Group winding head for manufacture of coils.

1 Coil taping machine.

1 18-in. insulation folder.

1 Coil spreader.

Miscellaneous meters test instruments, pneumatic tools, hand tools, etc.

Construction work on the building was started and progressed as rapidly as possible, but due to the difficulty in securing priorities as well as delivery of materials and equipment, the shop was not placed in full operation until the summer of 1944. By that time, the number of diesel-electric locomotives in service had increased to over 100 units, with additional units on order. It was evident, at that time, that some additional tools and equipment were needed to handle the increased volume of work. For example, one bake oven soon proved inadequate, and a second unit was installed in 1945. At present, there are three ovens in service in the shop to handle this work.

Will Overhaul 167 Motors Per Monnth

There are now 594 diesel-electric locomotive units in service on the Southern, handling over 80 per cent of the passenger and freight traffic. Additional locomotive units are on order, and it is expected that complete dieselization may be accomplished in the next several years. This will probably require over 1,000 units of freight, passenger and switcher types.

The size of the load on the traction motor repair shop can be appreciated when it is noted that 1,000 diesel units will have 4,000 traction motors, over 1,000 main and auxiliary generators and possibly 4,000 to 6,000 small motors to be overhauled and reconditioned at regular intervals. If we assume mileage overhaul of traction motors of an average of 200,000 miles service, and a locomotive 100,000 miles per year in all classes of service, it will be necessary to overhaul 167 motors per month. Some of these motors will have armatures requiring rewinding and, if we assume 750,000 miles average service before rewind, it develops that 44 armatures must be rewound each month. In other words, the expected shop

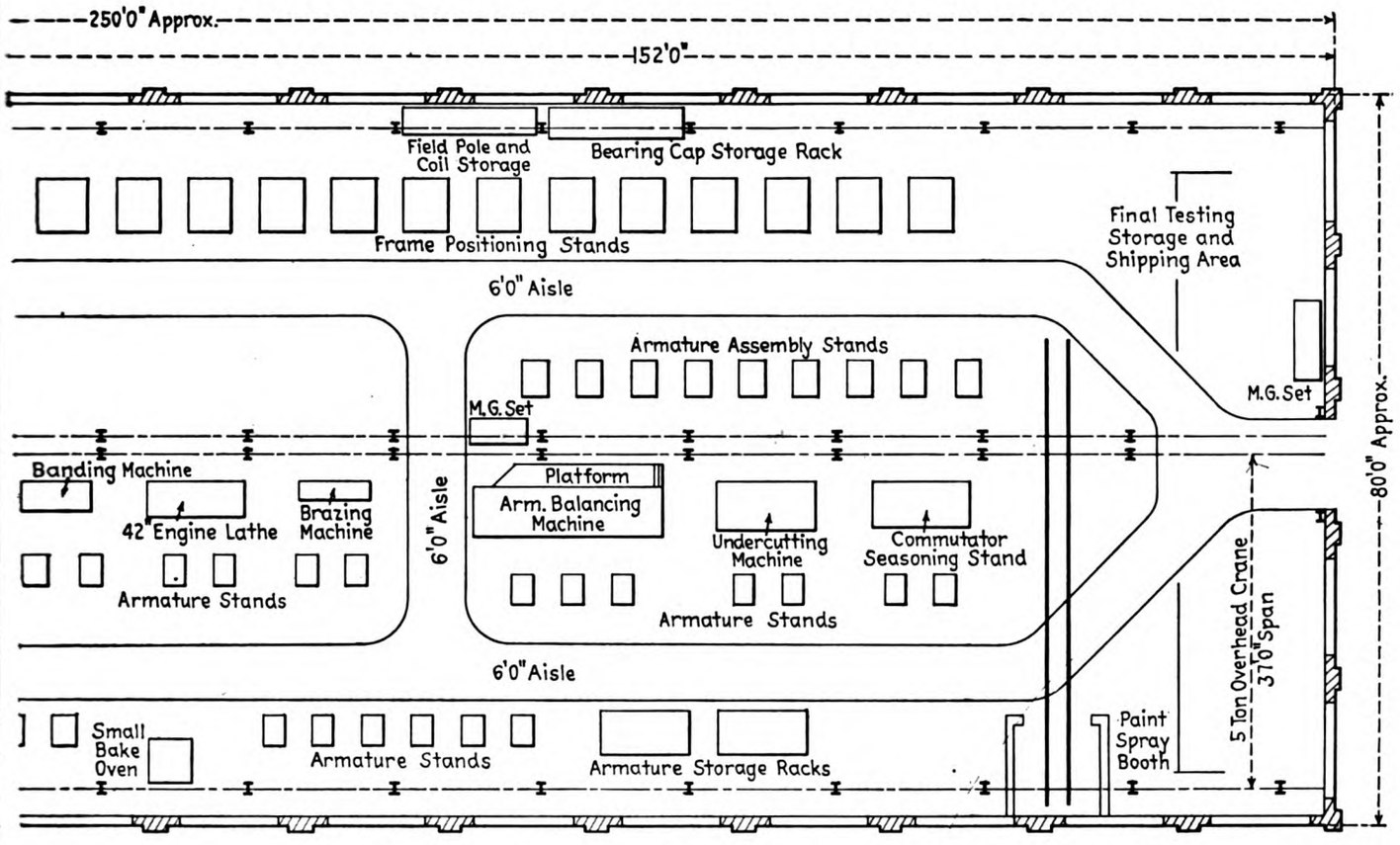


Fig. 2—Ultimate layout of machinery and equipment in the new shop extension

load with 100 per cent dieselization will be an average of 123 motors for basic overhaul, and 44 for rewind each month, a total of 167 motors per month.

Main and auxiliary generators will operate for greater mileage between basic overhaul and rewinds. With 1,000 locomotive units in service, it can be estimated that there



Rewinding area in former blacksmith shop with new extension and entrance to original shop in the background

will be 8 main generators for basic overhaul, and 8 for rewind, each month in the near future.

It should be noted however, that these figures represent average loadings. Orders for new locomotives are usually placed and deliveries received in groups so that there may be a decided difference in the number of motors scheduled for overhaul or rewind from one month to the next. There is some tendency for the peaks and valleys to be leveled out. For example, the number of motors removed from locomotives for overhaul is dependent on the number of spare motors available on the system. If sufficient spares are not available, the traction motors may be operated somewhat over the specified changeout mileage before they can be removed from service. These peak conditions are very important in the operation of a shop, and must be considered in the planning of the shop layout and equipment.

At present, the traction motor shop at Atlanta has an average output of 85 traction motors per month, approximately 10 of which are rewinds, 8 main generators for basic overhaul, and 8 auxiliary generators for basic overhaul. This increase in the volume of work over the original estimate of 25 traction motors to be overhauled each month has made it necessary to provide increased floor space and additional equipment.

The new building, completed in 1944, was placed in an area adjacent to what was then a flue shop, and across a transfer table pit from a group of buildings housing a blacksmith shop, pipe and tin shop, boiler shop and electric shop. It was anticipated that space in these buildings would be available as traction motor shop repair work increased, and steam locomotive work declined. Actually, as mentioned previously, the entire shop was converted to diesel-electric locomotive work several years ago, and unlimited space is now available for expansion. Fig. 1 shows the original traction motor repair shop at the right. At the left is the more recently developed diesel storehouse and repair shop for auxiliary generators, traction motor parts, small motors, train control, etc.

As the volume of work increased further, studies were made and an expansion program was recommended to provide space for immediate needs as well as to develop just what would be required in the ultimate arrangement. As a result of these studies, a new addition approximately 42 ft. wide by 70 ft. long was constructed connecting the original traction motor shop to the building housing the blacksmith shop. For the present, blacksmith shop work is concentrated in a portion of this building, 80 ft. wide by 152 ft. long, separated from the motor shop by a brick partition wall.

In addition to the floor space in the new extension, this made available additional space, 80 ft. wide by 98 ft. long. Two crane runways were installed, one for a 10-ton crane, extending from the original building wall, through the extension and up to the existing partition wall, a total length of approximately 165 ft. The second crane runway parallels the first, and covers the balance of the area in the former blacksmith shop, with a length of approximately 95 ft., and is provided with a 5-ton overhead traveling crane. At the same time, the flue shop building, an irregular shaped building, approximately 90 ft. by 135 ft., was converted for storehouse material and miscellaneous electrical work.

All of the equipment shown in the original traction motor shop (Fig. 1, right) has been purchased and installed with the exception of the high frequency test set, mica undercutting stand and certain armature and frame stands. Equipment such as the 60-in. engine lathe and two bake ovens have been added since the shop was placed in the operation.

The storehouse and small parts repair shop shown at the left in Fig. 1 was formerly the flue shop. Office and floor space is provided for the electrical foreman handling general shop work with space for repairs to shop motors, benches for overhaul of traction motor and main generator field coils, brush holders, frame covers, and for rewinding or repairs to auxiliary generators and small motors. Parts and items of material are transported from one shop to another on outside concrete driveways, however, it is proposed to cut a doorway in the end of the original shop wall to install a short covered or enclosed concrete driveway over the 25 ft. separating the two buildings.

Fig. 2 shows the ultimate layout of machinery and equipment in the new extension and in the entire area of the blacksmith shop. This will eventually include as many as 4 bake ovens, a second vacuum impregnator, a second balancing machine, mica undercutting stand, commutator seasoning stand, 600-ton vertical hydraulic press and grinder for shafts, high frequency test set and blast cleaning room. A lathe for stripping coils from armatures, the brazing machine, armature stands and a new banding machine have already been installed in the space between the new extension and the existing brick partition shown in dotted lines, while a vapor degreaser has been provided in a corner of the new extension adjacent to the wall of the original building.

The arrangement in Fig. 4 illustrates clearly the space available for expansion beyond the brick partition and the entire L-shaped layout is believed to be adequate in floor space to handle all diesel-electric locomotive traction motor, main generator, auxiliary generator and small motor work when the Southern system is completely dieselized.

Traction motors, generators, etc., are removed from locomotives in the erecting shop or are unloaded from freight cars received from other points on the system by means of an outside overhead traveling crane near the storehouse building. Gasoline tractor drawn trucks are used to haul them into the 42 ft. by 70 ft. extension where they are unloaded by means of the 10-ton overhead crane. At present, armatures and frames, after dismantling, testing and cleaning, move into the original shop for mileage overhaul. Armatures for rewinding move into the former blacksmith shop, where they are stripped and rewound as far as possible with the facilities now provided. They are then moved to the original shop for impregnating, baking, balancing etc., after which the armature and frame are assembled and tested in that building. When sufficient equipment has been provided, it is proposed to use the original shop building for mileage overhaul, and the entire area of the blacksmith shop for armature rewinds and frame repair with final assembly located as shown at the far end of the building.

An 8,000-lb. Yale & Towne fork lift truck, tractor, trailers and gasoline-operated Chore Boys have been provided in addition to the overhead traveling cranes covering various areas, for transporting frames, armatures, coils, parts, etc., from one section of the shop to another. Experience, thus far, with the sectional shop arrangement indicates that efficient operation can be secured without too much lost time or expense in moving materials from one area to another and future expansion will be generally in accordance with the ultimate layout shown in the drawings.

The operating procedures in this shop will be discussed in detail in a subsequent issue.

CONSULTING DEPARTMENT

Employee Morale

Proper maintenance of diesels requires facilities, material and skilled men interested in the work. How can morale be made an active factor in the diesel shop?

Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical and Electrical Engineer, 30 Church Street, New York 7.

In your March issue you asked how morale can be made an active factor in the diesel shop. To my way of thinking there is nothing else quite so important as the foreman in building up good morale. Now what I want to know is how do we find good men for foremen and how do we train them for the job?

There Are Three Primary Requirements

The arrival of the diesel-electric locomotive has brought many new problems to the railroads. Most important among these are labor relations and employee morale because trains are operated and maintained by people. Management and labor both have a job to cope with this complex problem. It must be solved if the railroads are to maintain their firm position as the No. 1 carrier of the nation's goods. This problem will not be solved by name-calling or casting aspersions at either labor or management.

Undoubtedly, there are or have been examples of soldiering and feather-bedding in every railroad shop in America. Examples of older employee's wilfully withholding information from younger men could easily be found in shops twenty or more years ago and still may be found in many shops. These deplorable conditions should never have existed, but to condemn blindly specific individuals or labor in general for their existence is as false as the medieval practice of beating lame and deaf children because they were believed to be possessed by devils.

The challenge to both labor and management is to get at the root of the problem. Adequate remedies can be applied only after careful diagnosis of the disease-producing agents. Let us assume, until it has been proven otherwise, that both labor and management are fair, honest and conscientious parts of an enterprise necessary to the welfare of our democracy and our way of living. We should all recognize that men are inherently reasonable persons and not basically malicious or dishonest. Fear, misunderstanding and improper guidance may drive any man to do unjust or short-sighted things because self-preservation and the protection of our material wealth are uppermost in all of our minds. This condition of fear is not the natural condition for men.

Displacing the steam locomotive and fitting in the diesel-electric units on American railroads have required much study and modification of existing shops and facilities and the changing of many operating procedures. It should have been evident to all persons concerned that problems and similar changes might have to be made with regard to the employees servicing these units. Where this problem has been recognized and faced honestly by both labor and management, the employees are happy, morale is high, and the railroad is in a prosperous condition. Where these problems have been ignored or handled inadequately, the reverse is true. These conditions should emphasize further to both labor and management that the job is not done until each employee is familiar with his new job, is happy in his work and is working in the best surroundings with the most efficient tools and training that modern advancements can provide. If both labor and management will approach the problem from the standpoint of training employees so that they no longer fear the intricacies of the equipment involved, and providing proper facilities and surroundings for good work, they will find that the problem of soldiering and wilfully withholding information will be reduced to an almost imperceptible quantity. This, in my opinion, is the only way that this cancerous growth of employee dissatisfaction and feather-bedding can be corrected. It certainly cannot be corrected by badgering or threatening; nor can it be corrected by restrictive rules, regulations or law-making.

To put into words the one element most likely to cause employee dissatisfaction is like trying to capture a graveyard ghost. Much philosophizing has been done about what man needs to be happy in most real and imaginary situations. I will not add to these volumes but will point out some items that loom large in my memory of twenty or more years of supervisory work.

Honesty and fairness were the most needed elements on both sides of the labor relation scales twenty years ago and are still the most needed element. This may seem like a contradiction of the fact that men are basically honest but it is not. Men, supervisors and employees, alike, are basically honest and fair but fear or ignorance drives them to dishonesty.

How many cases have you heard of men working on a job for five, ten or fifteen years and then learning that they were denied advancement or being discharged because they were unsatisfactory or unqualified? What justification can any supervisor have for permitting an unsatisfactory employee to waste five or ten years of his life on a job holding no future for him and not honestly and clearly telling the man what his standing is? How many foremen honestly, conscientiously and courageously talk over in private each month with each man under his direction that man's limitations, strengths and weaknesses? I know the answer. Lack of time and many job responsibilities loaded on the foreman do not permit these time-consuming practices. Can management then hold themselves blameless for the conditions of dishonesty, unfairness and selfishness on the part of the workers when their own short-sightedness provides an incubator for these corrosive diseases? What other job could possibly be more important to a foreman or a management than the peace of mind of his workers?

Constructively telling a workman about his weak-

nesses, inability or other limitations is not easy. It demands the utmost in foremanship but there is no otner way to get at the root of the trouble except for the foreman to do it. No. 1, therefore, on my list of things to do is the selection of foremen who are honest, courageous and fair to the Nth degree. Instill in these foremen a genuine interest in their fellowmen, train them in the techniques of dealing with people and give them enough time to do their job properly. This is not a short-time program but a continued campaign that sometimes takes a long time to bear fruit. This will do more to improve employee satisfaction than all of the other benefit plans put together.

The second item on my list of things to do is to increase the knowledge of the individual worker. This again is a job that must be handled on almost a person-to-person basis because of old fears and misunderstandings that have built up through the years. Shop schools, text books and special training courses are examples of management's attempt to cope with this problem. Manufacturers also can assist by writing and making available instruction books that the average workman can understand. These attempts on the part of management are laudible and their failure to correct the situation in some cases should not discourage their continued use. Such programs succeed as a direct function on the individual's willingness and desire to participate in them. Here, again, management should not be selfish in what it teaches. Perhaps better electricians are needed but the willingness to learn might be encouraged by giving a course in amateur "radio" or "oil painting".

The third item is as old as the hills. This element is to take the worker, the foreman and the janitor into the confidence of the management. There is nothing in the world that gives a quicker appreciation of your problems than to ask a man to help you solve them.

I would like to say a lot more, but these three are my major recommendations. Why don't you try them for a year and see if they do not produce improved results?

EDWARD STERLING LOWE

Jealousies Must Not Be Allowed to Flourish

I think I can best answer your question on how morale can be made an active factor in diesel shops by citing my own experience. In 1936, I started out as an electrician rider on our diesel-electric streamliners. I was very enthusiastic and studied everything on the trains diligently, so I could become the best man they had. And I soon gained the satisfying reputation of being just that. I rode thus for 11 years. Then, the superintendent of diesels asked for my promotion to diesel supervisor. This job gave me the opportunity to further expand my knowledge and skill. And this lasted satisfactorily for about two year, when the superintendent took his pension.

His place was taken by a man who received his appointment through the vice president. This man had had no previous railroad experience, but he was nevertheless a competent and intelligent college graduate. But he had, and still has, the disagreeable habit of treating non-college railroaders with condescension, and apparent contempt.

At this time, I personally, as well as all other diesel supervisors, were placed under master mechanics in various divisions of the railroad. And I had the misfortune of being placed under a man who carried his craft grudges into his high position. He was an ex-machinist, and I an electrician. And he wanted a machinist as an assistant. I didn't realize this for a long time, but I did notice that subversive propaganda, detrimental to me, was beginning to show itself. After a year and a half of this, I was demoted, and a machinist appointed in my place.

This was demoralizing, and the entire railroad felt the impact of it. All electricians have become resentful. Other officers of the railroad have become apprehensive, and are watching their superior's actions with suspicion.

On top of this, there is a strong tendency to hamstring the electrical department by refusing to appropriate money for such things as meters, and other testing equipment, or to provide the necessary wiring diagrams for an efficient electrical force.

These things are not conducive to good, efficient operation of diesel electrical equipment, and should be corrected.

What happens to me is not of such great moment, as I'm working as an electrician again, the youngest man at the point. But this is an example of how thoughtless and short-sighted railroad management can become. The plausible excuse given for my demotion was lack of supervisory ability. Well, this was partly true, because I was prevented from exercising supervisory functions by the master mechanic, who feared for the safety of his own job, and realized the threat of the electrical men in being promoted to the higher jobs.

I don't know if this example answers your question in a small way or not, but I believe it illustrates a condition that exists that should be given enlightened treatment.

GEORGE PERRY

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—How can proper cable arrangement and tray blocking provide a better battery installation?

A.—Battery terminal leads and intertray connectors should be arranged to prevent undue strain on the battery terminal posts.

The cables should not rest on the intercell connectors, and should be of ample length. Proper arrangement of

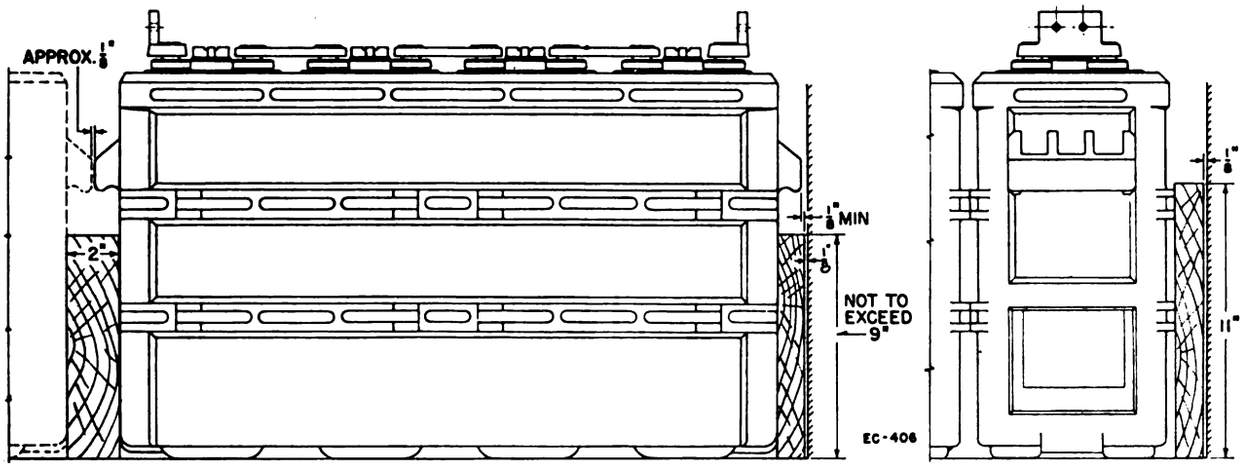


Quartet of diesel starting batteries showing neat cable arrangement and tight bolted connections

cables will prevent crushing between the trays, or the trays and battery compartment. Service records of The Electric Storage Battery Company show that rubbing action may destroy the insulation and cause grounds.

The cleaned parts should always be washed thoroughly in clean water and then dried.

S. K. LESSEY
The Electric Storage Battery Company



Recommended blocking for Exide Ironclad diesel starting batteries, Type MV-D

It is essential that the battery be well blocked in the compartment to prevent excessive moment. Clearance between battery and blocking at sides, back and front, should normally be about 1/8 in.

Blocking for "monobloc" trays should be high enough to bear against reinforcing strips on the sides and ends of the trays. The end blocking should not be higher than 9 in. above the tray bottom. The side blocking must engage both the upper and lower container ribs as shown in the sketch. This is illustrated by the diagram.

Do not wedge!

Q.—What is the procedure for making bolted battery connections?

A.—Before connecting the battery, clean the contact surfaces of the solid lead terminal posts with a wire brush. The lead-coated copper lugs and intertray connectors should not be cleaned with a wire brush, since the thin lead coating might be removed.

Apply a thin coat of Grade A, No-Ox-Id grease to all contact surfaces connector bolts. Tighten the connector bolts securely by using two wrenches, not over 6 in. in length (preferably box type), one on each connector bolt nut. The use of two wrenches lessens the strain on the battery terminal posts.

After all connections have been securely tightened, they should be gone over and tightened a second time. All connections should then be wiped off with a clean cloth to remove the surplus grease. The four batteries in the illustration have been properly connected and cleaned of grease.

Heavy currents are required to start a diesel engine. Tight and clean connections will help prevent starting failures.

The Electric Storage Battery Company recommends that corrosion on connector bolts, lugs and cables be removed by washing in a hot soda solution, consisting of one pound of commercial bicarbonate of soda to one gallon of water. Severe cases of corrosion are removed more quickly, and effectively, if the solution is near the boiling point.

A. C. Power Plants For Passenger Cars

(Continued from page 72)

controlled by superimposing d.c. excitation upon the regular a.c. excitation on the core. The d.c. excitation is varied through a motor-operated rheostat which is, in turn, controlled by the car-temperature system. Excellent modulated control of the overhead electric heat is obtained in this manner.

Controls for the air-conditioning and generating equipment are relatively simple. All controls for air-conditioning equipment are placed on a Micarta panel. Equipment on this panel includes contactors for each compressor and evaporator fan. Panelboard-type breakers are used for each of these pieces of equipment as well as the electric-heating circuit. The remaining item on the panel is a timer that prevents the compressors starting at the same time. The timer is necessary to prevent light flicker at temperature conditions that would place the two compressors on the line simultaneously. The second compressor is thus prevented from starting until 15 seconds after the first one starts. Controls for the power plant are placed on a Micarta panel and include the main line contactor and breaker along with two control contactors. The equipment is fully automatic, one push-button being pressed to start the entire system in operation and another to stop it.

The Rock Island car "Northfield" had been previously equipped with 32-volt, d.c. lighting. It was decided to leave these lamps in and operate them on 32 volts a.c. through a 220-32-volt transformer.

The car battery required for the system is rated 284 amp.-hr. and its function is to provide emergency lighting for a period of eight hours in addition to providing power for the control system, alternator main field, and engine starting. Charging of the battery is accomplished with a selenium 60/25-amp. two-rate charger.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

ALARM AND INDICATOR LIGHTS

193-Q.—Explain the operation. A.—When the temperature of the cooling water reaches 185 deg. F, the high water temperature switch will close causing the hot engine red lights to light.

194-Q.—Is there any additional alarm? A.—Yes. The buzzer sounds (road locomotives only) as well as the alarm bell in all units.

195-Q.—Does this have any effect on the engine speed? A.—Yes. The affected engine is returned to idle.

196-Q.—When does the Low Lubricating Oil Pressure Light function? A.—When the engine lubricating oil pressure drops to 20 psi. but not below 7 psi., with the throttle in the fifth, sixth, seventh or eighth notch and with the engine control switch in *6* or *run.*

197-Q.—What switch is operated at this time? A.—The oil pressure switch OPS-1 will open and light the low lubricating oil pressure green light.

198-Q.—What further action takes place? A.—The buzzer sounds (road locomotives only) and the alarm bell in all units and affected engine returns to idle.

199-Q.—What happens if the oil pressure drops to 7 psi. or less? A.—Switch OPS-2 will open causing the alarm to sound and the affected engine to shut down regardless of throttle or engine control switch positions.

200-Q.—With what equipment is the Boiler Flame Out light associated A.—The steam generator.

201-Q.—When does this light function? A.—When the steam generator stops.

202-Q.—Explain the operation. A.—The boiler alarm relay will close, causing the boiler flame out light (white) to light, buzzer (road locomotives only) and the alarm bells to sound in all units.

203-Q.—What is the purpose of the Ground Relay and Blower light? A.—On road locomotives, if a ground occurs in the high voltage circuit of any unit or connected units, the white ground relay and blower light will light in the unit affected.

204-Q.—What further action takes place? A.—The buzzer and alarm bells will sound in all units and the affected engine will return to idle.

205-Q.—For what other purpose is the ground relay and blower light? A.—It indicates a traction motor blower failure.

206-Q.—How is this indicated? A.—The white light will light in the affected unit and the buzzer and alarm bells will sound in all units.

207-Q.—How is a ground detected on a single or multiple connected road switching locomotive? A.—The white ground relay light will light, the engine affected will return to idle while the alarm bell will ring in all locomotives.

• This series of questions and answers relates specifically to the Alco-G. E. diesel-electric locomotives.

Correction Notice

In diesel-electric locomotive questions published in the February issue the answer to question No. 117 stated that the 6-SL equipment is used on road switchers and that older models have the 6-DS equipment. Our attention has been called to the fact that on road switching locomotives the 6-SL, 6-BL and 24-RL brake equipments are being currently installed. The older models have had the 6-DS and 14-EL equipment.

Steam Locomotive Boilers

By George M. Davies

Cold Bending of Pipe

Q.—What is the best method for cold bending extra heavy wrought iron pipe?—A. M. B.

A.—In making a pipe bend, the stretch in the metal has a tendency to localize at the central portion of the bend rather than to distribute itself uniformly. Therefore, successful results are obtained only by following a practice that will permit no portion of the bend to stretch the pipe beyond the safe limit.

When bending pipe, either by hand or machine, it is desirable to conform to three main requirements:—

1. The bending stress should be applied successively to short sections of the pipe.

2. The bent or stretched pipe should be advanced out of the bending zone and should not be subjected to further stress.

3. The force which does the bending should be applied as a steady pressure and not as a sharp blow or impact.

What Determines Water Space?

Q.—The water space between the firebox sheets varies on the different classes of steam locomotives but generally the water space between the firebox side sheets is less than the water space provided at the throat sheet and at the backhead. What is the reason for this?—R. E. L.

A.—The properly designed boiler provides ample water space around the fiebox so that the water from the barrel of the boiler can readily pass thru the throat, back along the sides of the firebox and up along the backhead without being retarded as a restricted water space can result in burned out side sheets and staybolt trouble. The general practice is to provide ample water space between the firebox sheets increasing the width of the water space at the throat to make it easier for the water to back along the side sheets and at the backhead so as not to restrict the flow of the water up and over the backhead.

Capacity of Automatic Blow-Down

Q.—On a locomotive equipped with an automatic continuous blowdown, how does the amount of water blowdown compare with the amount discharged from the conventional blow-off cock?—F. E. C.

A.—The following tables give the comparative amounts

of water blow-down by the conventional blow-off cock verses an automatic bow-down system.

1½ In. Blow Off Valve

Gage pressure	Gals. per sec.	Gals. per min.
188	2.92	175
190	3.05	183
200	3.10	186
210	3.17	190
240	3.40	204
250	3.47	208

2 In. Blow Off Valve

180	5.20	312
190	5.37	322
200	5.50	330
210	5.62	337
240	6.03	362
250	6.13	368

Constant Blow Down

Pressure	Size of Orifice (In.)	Gals. per min.	Gals. per hr.
180	5/32	3.7	222
200	5/32	3.9	234
240	5/32	4.3	256
180	6/32	5.3	320
200	6/32	5.6	338
240	6/32	6.1	370
180	7/32	7.3	435
200	7/32	7.7	460
240	7/32	9.3	504
180	8/32	9.5	567
200	8/32	10.0	600
240	8/32	11.0	658
180	9/32	11.9	715
200	9/32	12.6	756
240	9/32	13.8	829
180	10/32	14.7	885
200	10/32	15.6	938
240	10/32	17.1	1031

Toe Brick in Locomotive Arches

Q.—What are the advantages of using toe brick in the arch of a locomotive boiler?—R. F. K.

A.—The use of toe brick in the arch of a locomotive boiler is to set the front row of arch brick away from the tube sheet a distance of from 5 to 6 inches, in order that the cinders collecting at the bottom of the arch will drop down into the firebox and not plug up the bottom flues. The advantages of the open or vented arch are at best very controversial and depend a great deal on the fuel used, the open arch being most advantageous in territories where the fuel cinkers when when burned.

Schedule 24 RL Air Brakes

Automatic Train Control

1108-Q—What is the function of the A-1-suppression valve? A.—This valve is recommended when temporary and permanent suppression of train control application is desired.

1109-Q.—How does the acknowledging valve function? A.—This valve is for the purpose of permitting the engineman to properly recognize the change to a more restrictive indication, also to permit a train movement at the low speed limit under a restrictive indication through medium of recurrent acknowledging operation.

1110-Q.—When are the No. 1 and No. 2 acknowledging reservoirs used? A.—The No. *1* acknowledging reservoir is only used when operating under an intermittent magnetic induction stop system. Both No. *1* and No. *2* reservoirs are used when operating under a two-indication continuous cab signal system with two-speed control or without speed control.

1111-Q.—What does the Suppression Reservoir 19 provide? A.—It provides a permanent suppression of a train control brake application when a manual automatic brake application of prescribed amount is in effect.

1112-Q.—How does the Suppression Timing Reservoir function? A.—This reservoir is connected to the automatic suppression portion through the rotair valve for the purpose of providing continued automatic brake valve partial suppression of a train control brake application by means of successive manual brake pipe reductions of moderate amount when the rotair valve is set in FRGT position.

1113-Q.—What is the purpose of the timing reservoir? A.—It serves as an operating volume in combination with the timing valve to hold the train control brake application suppressed for a period of about six seconds after the timing valve is de-energized.

1114-Q.—What does this permit? A.—It permits the operator to move the brake valve to a brake applying position, wherein suppression of a train control application is governed by the positioning of the brake valve or the degree of brake application.

1115-Q.—With what basic types of automatic train control and cab signal devices is the 24-RL equipment adaptable for? A.—A—Continuous cab signal system with speed control; B—Continuous cab signal system with automatic stop; C—Continuous cab signal system with whistle and acknowledger; D—Intermittent automatic train stop.

1116-Q—What does the Cab Signal System with Speed Control provide for? A.—The initiation of an automatic service brake application when pre-determined speed limits in accordance with signal indications are exceeded.

1117-Q.—Can this brake application be suppressed? A.—Yes.

1118-Q.—How is this done? A.—This brake appication may be suppressed if the engineer initiates and maintains a full service manual brake application until the speed has been reduced below the predetermined limit.

1119-Q.—What does the Cab Signal System with Automatic Train Stop provide for? A.—The initiation of an automatic service brake application and stop, when the signal changes to a more restrictive indication.

1120-Q.—How may this brake application be forestalled? A.—This brake application may be forestalled by the engineman if the signal change is acknowledged within approximately six seconds.

1121-Q.—Does the Cab Signal System with whistle and acknowledger include any automatic brake applying features? A.—No.

1122-Q.—What does it provide for? A.—The sounding of a whistle following each change to a more restrictive signal indication.

1123-Q.—How long does the whistle sound? A.— Continues to sound until acknowledged by the engineman.

1124-Q.—What does the intermittent automatic stop system provide for? A.—The initiation of an automatic brake application and stop when the engine passes a *Stop* or *Approach* wayside signal.

EDITORIALS

Super-Vision For Supervision

Railroad supervisors need *super-vision* today as never before and the question is where are they going to get it. Some very pertinent comments on this subject were included under the title mentioned above by H. C. Marmaduke, executive representative, Illinois Central, in addressing the April 9 meeting of the Car Foremen's Association of Chicago. In this talk, the point was made that when a competent workman, Sam, is promoted to boss, however humble, he receives no touch of a magic wand to make him, overnight, a competent leader, trainer and developer of men. There are no high-power glasses which can be placed on Sam's nose to give him all-seeing eyes. Except for the few instances in which Sam is perhaps a natural-born supervisor, there is no recourse but for him to learn from his own experience and that of others which may be available for study in lesson form.

Mr. Marmaduke was on sound ground in saying there are many things which will be helpful to Sam, but attention to the five following fundamentals will solve most of his problems: Study the subordinates who work for him; learn to like and be considerate of them; delegate responsibility; let others in on company plans; and make people want to do things by leading instead of driving and always giving credit where credit is due.

By the same token, there are many things for a supervisor to guard against such as: Keeping men on jobs for which they are not fitted; failing to realize that some men can't stand praise and others criticism; giving any evidence of partiality, unfairness, lack of courtesy, consideration and willingness to credit subordinates with all worth-while ideas they may originate.

One of the major things to guard against, and an error frequently encountered, is keeping subordinates in ignorance of what is going on and why. Probably plans and programs cannot in all instances be publicized too far in advance, but in general it is a good idea to discuss changes with those involved beforehand, so they can make suggestions and feel some personal responsibility for success of the plan finally adopted. This will make the practical carrying out of any particular plan much easier.

Constant study, reading selected books and trade publications, such as *Railway Mechanical and Electrical Engineer* in the railway field, are essential for supervisors to know what is going on in their industry and thus be better qualified to direct their subordinates more efficiently. Returning to the idea of Sam and his glasses, Mr. Marmaduke interestingly suggests that, if he were a great oculist, he would fit this supervisor with bifocals for distance vision in planning and short vision for the job in hand. He would grind the lenses for human consideration and kindness, delegation of responsibility, full consultation in planning and leadership in production. Such a prescription would undoubtedly be difficult to fill, but who would doubt its effectiveness in giving Sam Super-Vision?

Mr. Marmaduke's discussion, like most others of this subject, is devoted to the technique of supervision, that is, the know-how. This, and certain characteristics of personality which he mentions are important. One personal characteristic which is of supreme importance, however, is seldom mentioned in any discussion of this subject. That is a character of such strength that it is never afraid to face issues—never afraid to deal fairly and forthrightly with all personal problems as they arise. Without this quality, the know-how and the best of intentions will never achieve complete success.

Dignified Acquiescence Vs. Enthusiastic Cooperation

Shop operators will generally agree that employee morale is the most important factor in successful shop operation: that wooden ships and iron men are to be preferred to iron ships and wooden men. Of course, it should not be inferred from this that good shop equipment is unimportant, but it must always be recognized that a poor piece of equipment will work pretty well if the operators like it and understand it, and even the best will fail if they don't. Similarly, if the men like the work in the shop, and understand that they are personally responsible for an important part of the job, the quality of output will improve accordingly.

Some railroad conditions which discourage the enthusiastic young man when he starts working in the diesel shop were outlined in the March, 1951, issue in an editorial entitled, "The Neglected Tool." This told only part of the story, and it brought prompt response from the forthright Mr. Lowe. In the Consulting Department of this issue, with convincing sincerity and understanding, he states that there are three primary requirements for establishing and maintaining good shop morale. Also, in this issue, George Perry recites his own experiences which show the effect of personal differences, petty jealousies and fear.

Perhaps Mr. Lowe has oversimplified the solution to the problem. Probably the circumstances described by Mr. Perry must always be expected in greater or less degree. But one thing is certain. If it is discussed broadly, so that all sides of the question are understood by everyone, there will be little opportunity for bad behavior on the part of anyone. The dignified acquiescence

that results from being told exactly what to do will be replaced by enthusiastic cooperation when workers and management come to realize they can benefit equally by working together.

Just how to go about doing this is not simple. There are many things which can contribute to the desired results. Will you let us have your opinions and suggestions?

Smoke Can Be Reduced By Proper Maintenance

Some interesting and useful data for mechanical supervisors concerned with either steam or diesel power is contained in a progress report issued by the city of Columbus, Ohio, on that city's smoke regulation plan. Study of over 1,500 smoke violations for the years 1949 and 1950 show not only that proper maintenance, efficient handling and good fuel are key factors in reducing excessive smoke, but that proper maintenance alone can be a far more important factor in smoke regulation than overloading.

For both years approximately half of the total violations occurred on light locomotives. From this the report concludes, "The old complaint of overloaded equipment cannot be sustained in the face of these facts, . . . supervision must assume its responsibility in closer policing of this type of operation." Another portion of the report states, ". . . good equipment is essential to any smoke regulation program, whether it is diesel or steam power, and it has been definitely proved that if either type of power is not maintained in the proper condition it will quickly become a nuisance to the city."

The figures from which these conclusions are drawn are as follows, and include the years 1949 and 1950: Passenger locomotives, which are in general the best maintained, accounted for only 52 violations compared to 407 for freight and 349 for switching locomotives. The remaining 744 violations out of a total of 1,552 occurred on light locomotives.

Mechanical men can well benefit from the figures and conclusions in this report because smoke regulation is becoming an increasingly greater problem to the railroads. Not only does black smoke represent growing dollar loss as fuel prices increase, but more and more cities and towns are enacting smoke regulation ordinances which the railroads will find far easier to conform to if they know as much as possible about what causes locomotives to emit excessive smoke.

NEW BOOKS

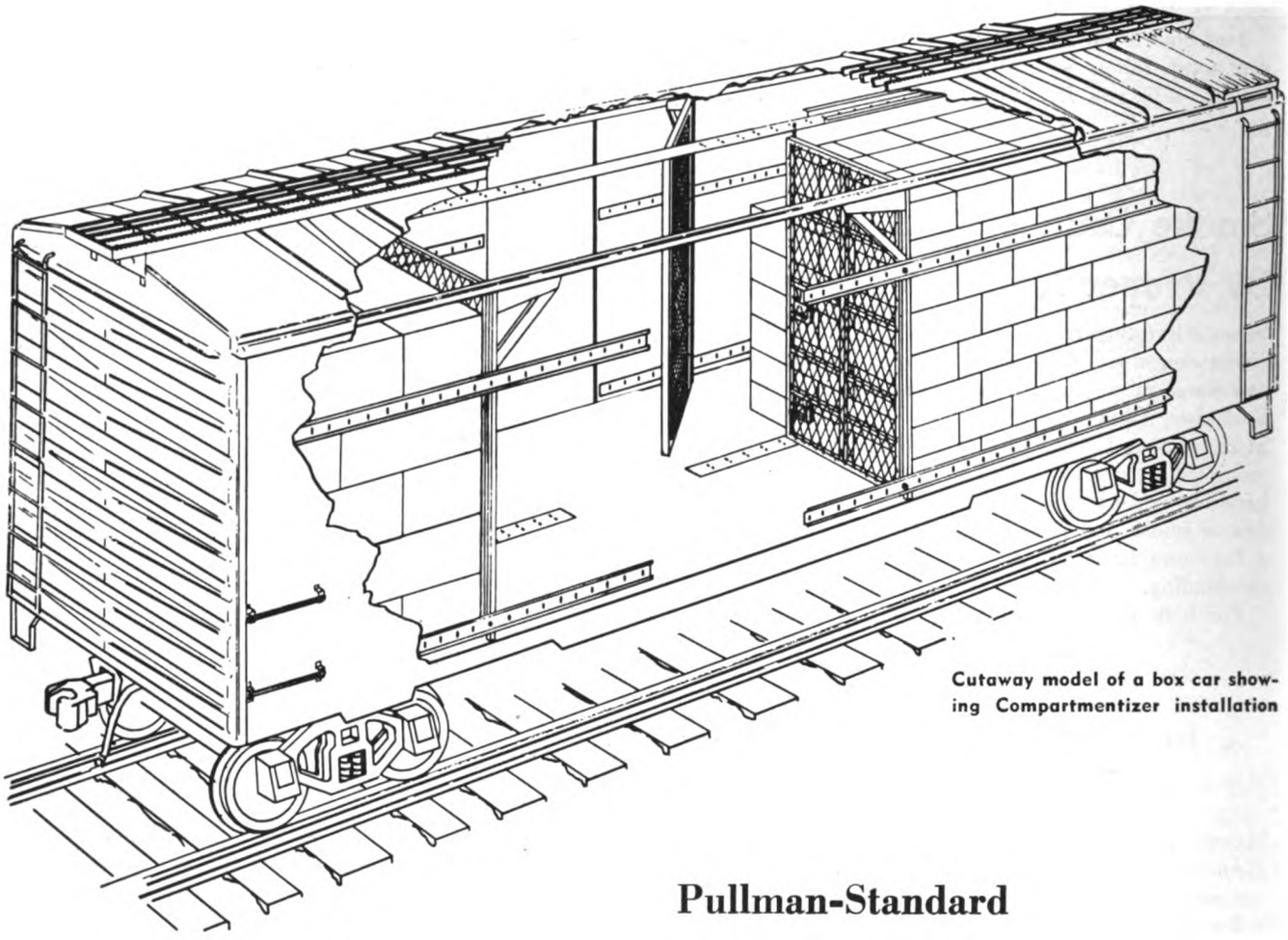
MARKS' MECHANICAL ENGINEERS' HANDBOOK.—*Revised fifth edition. Edited by Lionel S. Marks. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. Over 2,200 pages, 6¼ in. by 9¼ in. Price, $15.*

The index to this fifth edition of Marks' Mechanical Engineers' Handbook has more than 12,000 entries covering theory, standards, and practice in every branch of mechanical engineering— from aeronautics to mechanical refrigeration; from power generation to welding; from metal-cutting machines to hoisting and conveying. Among the new or greatly revised items are: *Theory*—fluid mechanics, elastic and plastic defomation of materials, stresses in turbine disks, transonic and supersonic aerodynamics, aircraft jet propulsion, rockets, radar, television; *Processes*—radiant or panel heating, solor heating, heating by heat pumps, vapor-compression distillation, high-vacuum pumps, modern casting methods, dust explosions, industrial supersonics, machining of plastics, automatic process control, statistical quality control; *Materials*—ferrous and non-ferrous alloys, superalloys for highest temperatures, plastics, elastomers, silicones, adhesives, fibers, explosives, rocket fuels, reflective heat insulation, powder metallurgy; *Power*—gas turbines, atomic power. Many new names appear in the list of over 100 contributors who are specialists in engineering and science. The arrangement of the 16 sections is essentially the same as in the preceding edition. The new and revised material is included in the appropriate parts of the book.

ECONOMIC ASPECTS OF ATOMIC POWER. *By Sam H. Schurr and Jacob Marschak. Published for the Cowles Commission for Research in Economics by the Princeton University Press, Princeton, N. J. 290 pages, 6¾ in. by 10 in. Cloth bound. Price, $6.*

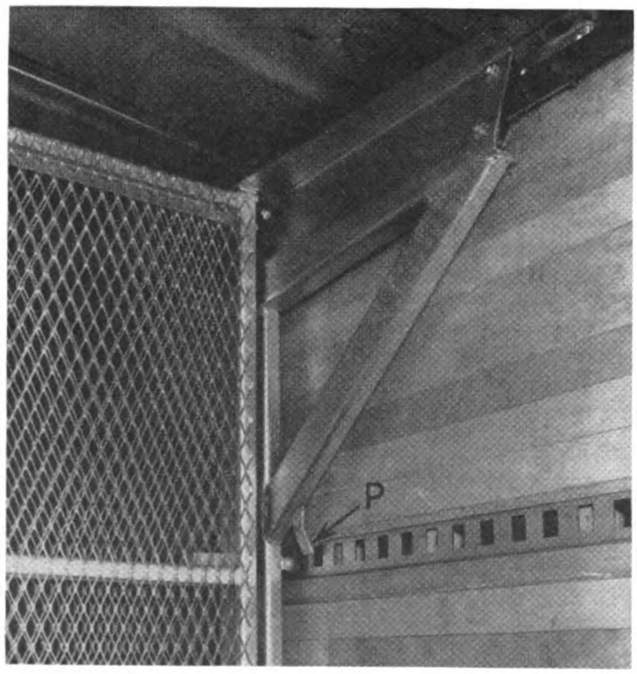
This "Exploratory Study" is confined to those applications of atomic power that seem least remote today. It deals only with applications based on a continually controlled release of energy within a permanent structure (the "reactor") rather than on explosions. Part 1, Economic Comparisons of Atomic and Conventional Power, analyzes questions relating to the supply of energy. Part 2, Atomic Power in Selected Industries, examines the effects of the availability of low-cost heat and power upon the productivity, location, and output of specific industries. Part 3 discusses Atomic Power and Economic Development. Railroad Transportation, one of the selected industries covered in Part 2, is the subject of a 17-page chapter. Section A discusses the important variables affecting the economies of railroad motive power, blocking out broadly the types of regions in which electrification based upon atomic power might be economically justified, and the types of regions for which a reasonable case for electrification cannot be made. Section B considers the important variables in the economics of railroad motive power, and Section C the implications of atomic power for railroad electrification in the future. The appendix to the chapter is on the feasibility of using nuclear power plants in railroad locomotives.

NEW DEVICES



Cutaway model of a box car showing Compartmentizer installation

Pullman-Standard Compartmentizer

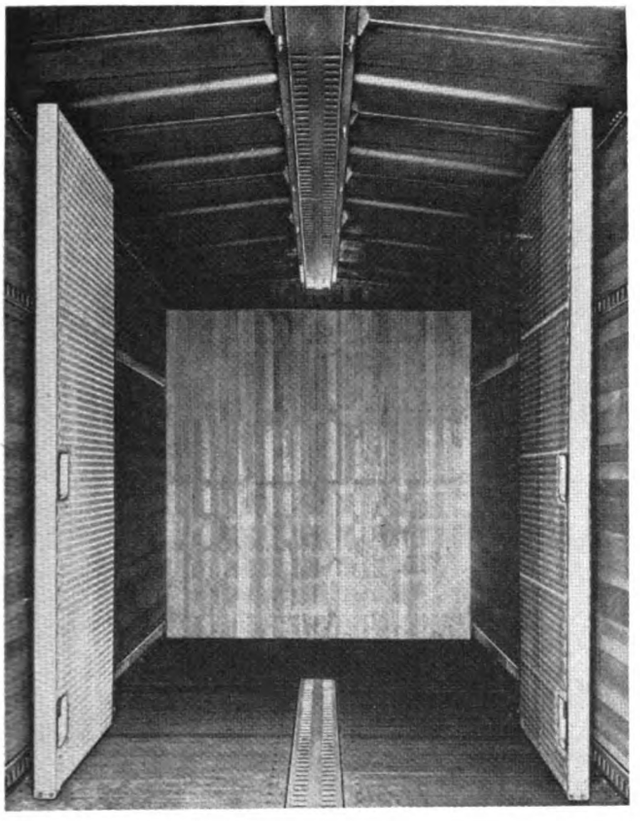


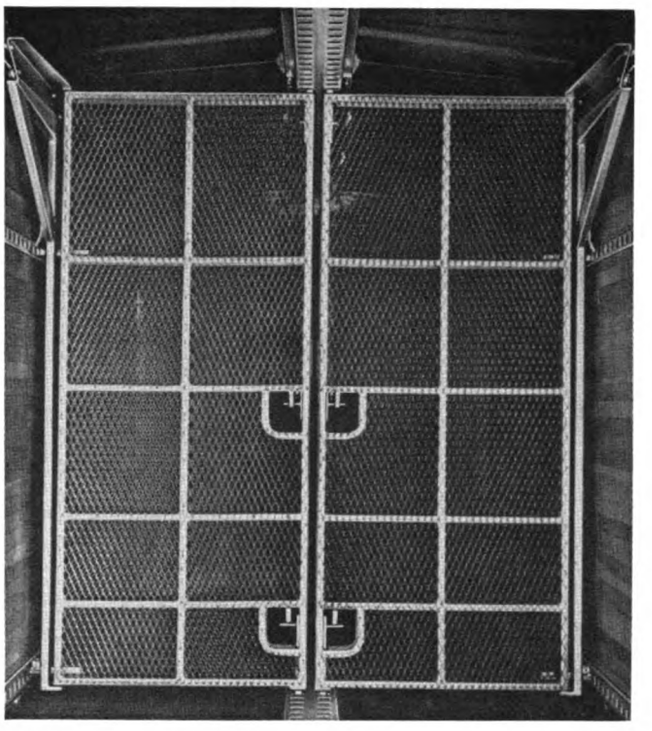
Hinged steel gate suspension and position indicator, *P*

The Compartmentizer, now being made and marketed by the Pullman-Standard Car Manufacturing Company, Chicago, consists of two pairs of longitudinally adjustable steel gates which may be installed in box or refrigerator cars to make three sections of variable size, as needed for stop-off service or some i.c.l. loads. The design reduces the chance of loss and damage claims and does not interfere with the value of the car for general-purpose freight shipments.

Advantages claimed for the new development include: ease of adjusting the gates; increased car loading capacity; shipment segregated for each consignee, individually secured and sealed; safer method of loading, with dunnage eliminated for most shipments and no individual parts to become lost or misplaced.

The Compartmentizer consists of four swinging gates, two right hand and two left hand. Each gate is approximately a 4-ft. by 10-ft. frame made of structural steel channels with all welded construction, covered on each side by expanded metal with openings on one side to allow ready access to locking handles. Gate sides are essentially flat and free of projections.





Left: Compartmentizer with steel gates open ready for loading; Above: Gates closed and locked

Manually-operated means are provided at the inside edge of each gate (both top and bottom) for locking gates near the car longitudinal center line. The locking arrangement is a simple mechanism to allow engaging square steel locking bars in suitable rectangular holes in the pressed steel center ceiling and floor plates.

Each gate is hinged to a vertical pivot member carried by a trolley which operates on a longitudinal track secured to the car side near the roof. One continuous track and two gates are on each side of the car. The gates work independently of each other and may be secured in the same axial straight line or staggered.

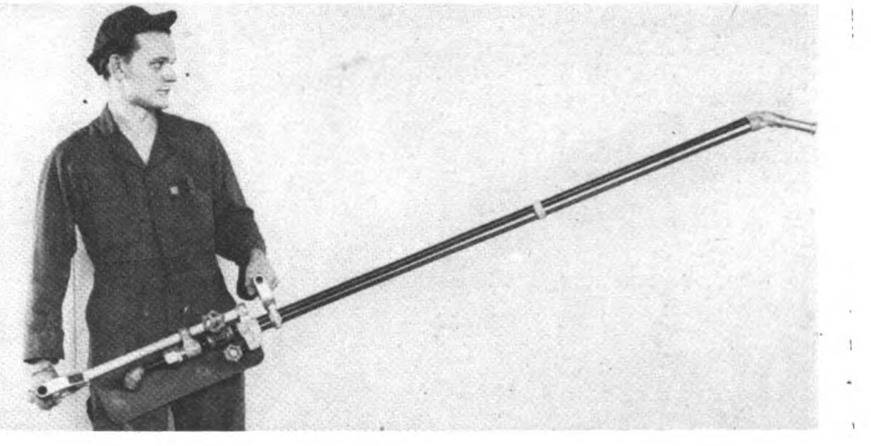
A lateral thrust roller in the lower portion of the vertical pivot member bears against the lower side wall keeper and maintains the gate essentially in a vertical plane for all gate positions. Another identical keeper plate is in the car side near the upper portion of the gate. Two fixed square steel horizontal locking bars on each gate automatically engage with the locking recesses in the upper and lower side wall keepers when the gates are moved into their service "across the car" positions. A visual indicator assists in proper positioning of the gate prior to automatic locking at sides. Locking slots are spaced on 3-in. on centers extending between door post and bolster. Provisions are made for securing the gates when not in use at the car end. Gates are readily removed by dis-engaging upper pivot pins.

Steel keeper plates at roof and floor centerline allow for final manual locking of gates, each one in four places at the roof, floor and car sides. Readily removable access plates in the floor keeper facilitate cleaning. There are no loose pieces in the entire application.

Solution-Lifting Steam Gun

For use in heavy-duty steam cleaning applications, a steam gun, the model 502 Oakite. Solution-Lifting Steam Gun has been announced by Oakite Products, Inc., New York 6. This device is designed for use where range of pressure at boiler end of hose while gun is in use is 50 to 100 lb. per sq. in., with minimum boiler rating of 25 or more hp. recommended. With this gun, the manufacturers report, steam detergent spray is lifted 12 ft. above the working level to provide cleaning of large equipment and other surfaces.

The gun, 7½ ft. long and weighing 15¾ lb. is equipped with two cast alu-



minum spade-type insulating handles. The forward handle remains stationary, while the rear handle easily turns and rotates the entire gun for cleaning in hard-to-reach locations. A safety feature is the reinforced-rubber apron backing up the steam valve and other hot fittings to protect operators from contact burns.

The device is equipped with machined seamless steel nozzle, $^{15}/_{16}$ in. inside diameter and inner jet. A flat nozzle is also available where wide-angle spray cleaning action is desired. Control valve furnished with the gun are a ¾ in. globe valve for steam and a ¼ in. globe valve for solution control. Also provided is a cast brass strainer of fine-mesh brass screening for use at the tank end of the solution hose.

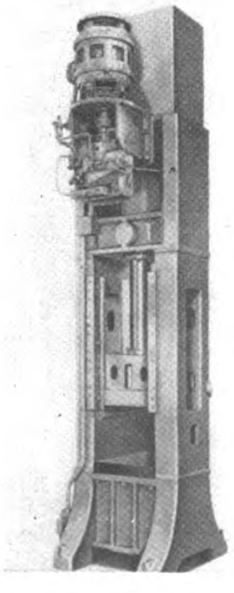
Pipeless Circuit Hydraulic Press

Development of a new principle in hydraulic press construction has been announced by Elmes Engineering Division, American Steel Foundries, Cincinnati 29, Ohio. In these pipeless metal-working presses, the main hydraulic circuit has no piping. The only pipes in the entire press are the pilot, suction, and drail lines, and of these, only the pilot line carries high pressure. All high pressure fluid is conducted through short, direct passages drilled in the structural parts.

These advantages over the conventional hydraulic system make for remarkable low-cost maintenance, with downtime practically eliminated. The pumping unit can be removed as a unit assembly without disconnecting any piping. The valve unit, located in the reservoir is also removable as a unit assembly. All pumping units and valve groups fit standard bolting and drilling layouts.

Reversing type hydraulic pumps, known to give smooth press performance, are used in the new circuit. Since the shifting and centering system is mounted directly to the hydraulic pump, only electrical or mechanical connections need be made, depending on the style of control.

The pipeless valve unit is the heart of the new unit, containing all necessary provisions for pre-filling during rapid advance, changing to pressing speed by either pressure or position, and decompression prior to reversal. These valves are designed in a wide range of sizes for application to many different speeds and tonnages. Any Elmes hydraulic metal-working press, standard or special design, can be supplied with pipeless construction for the main hydraulic circuit.



Recorder Measures Rotor Temperature

An electronic recorder for measuring temperature of rotors in large electric generators has been developd by the Brown Instruments Division, Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

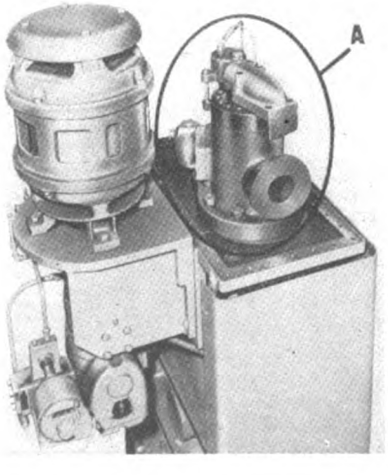
This unit, named the Electronik has been designed to assist operators in avoiding overloads. In addition, the instrument furnishes a 12-in. strip chart record which can be used as a guide for gradually cooling a generator.

It has a range of 0 to 150 deg. C, a limit error of 1.5 deg. C, a dead zone of 0.3 deg. C, and a pen speed of 1.4 min. full scale. Its range of rotor winding resistance is 0.1 to 4.0 ohms and it has a dielectric test of 1,500 volt rms for 1 min.

Strain Gages for Measuring Tension

Load cells, type P, for measuring forces or weights in tension only are announced by Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa. Load capacities of the cells are 10,000, 20,000, 50,000 and 100,000 lb. Other sizes will be made to order.

The illustration below shows at *A* the pipeless pilot unit.





Load measurement is based on the use of SR-4 resistance wire strain gages bonded to a load-carrying shaft. The gages respond to infinitesimal stretch of the shaft under tensional load by a change in electrical resistance that varies the voltage. This change of voltage is measurable on a rugged, direct-reading dial indicator or a recorder of either the resistance potentiometer type or the sensitive micro-ammeter type. It may also be used to actuate relays for automatic control mechanisms. Electrical instrumentation may be located near or far away from the load sensitive element.

A single indicator may be used to obtain separate measurements from a number of load cells, if desired, or a load may be distributed among several cells whose combined output may be automatically totaled.

Accuracy of measurement is within ±¼ per cent of rated capacity. The cells are temperature and modulus compensated. Standard cells loaded to capacity for several weeks at room temperature varied a maximum of 0.1 per cent of the initial load without change in measuring performance. The cell is made relatively impervious to moisture and dirt by O-ring seals. External circuits can be protected by sealed conduits.

Applications include suspension of tanks and platforms, measurement of thrust carried in tension, engine dynamometers, portable weighing hoppers, and cable tension testing.

Hand Brake Conversion Unit

A conversion unit for modification of standard Ajax No. 1 hand brakes into stand-still wheel types has been announced by the Ajax-Consolidated Co., Chicago, Ill.

Rather than design and manufacture a completely new unit, Ajax-Consolidated felt that the basic design of its No. 1 brake which is almost universally standard on railroads could be modified to incorporate the stand-still wheel feature without making present installations obsolete.

The conversion unit is furnished on specifications to those desiring the stand-still wheel feature. The hand brake with this feature is Ajax No. 2.


INGERSOLL
INGERSOLL

NEWS

I.C.C. Seeks Locomotive Inspectors

ANNOUNCEMENT No. 284, issued March 27, 1951, by the U.S. Civil Service Commision, Washington 25, D.C., gives the locations, of positions, a description of the work, an outline of the personal and physical requirements, and other general information needed by applicants to qualify for examination for inspector of locomotives for duty in the Interstate Commerce Commission. The positions are rated at $5,400 a year (Grade GS-11).

Application Form 5000-AB may be obtained from any first- or second-class post office, except in cities where a United States Civil Service regional office is located; from the Civil Service Commission at Washington, and in the Panama Canal Zone from the Secretary, Board of United States Civil Service Examiners, Balboa Heights, C.Z.

No closing date has been set.

A.A.R. Mechanical Division Releases

JOURNAL BOXES— AIR BRAKE HOSE

Two A.A.R. Mechanical Division circulars, issued under date of March 7, contain the latest instructions about repacking journal boxes and conserving natural rubber in air brake and signal line hose. The circulars are reproduced practically in full for the benefit of car men who may not see or have a chance to study them in the original. Both circulars are signed by V. R. Hawthorne, executive vice-chairman of the division.

REPACKING JOURNAL BOXES

Effective January 1, 1951, Interchange Rule 66 was modified to provide more frequent periodic attention to journal boxes. At the same time new Par. (j-3) was added to Interchange Rule 3 to permit the receiving road to reject empty cars from owners having repack dates more than 15 months old.

These changes were made for the purpose of providing more frequent attention to the lubrication details on freight cars, particularly on the part of car owners with respect to their own equipment, with the view of reducing troublesome hot boxes.

In order to avoid rejection of empty cars from owners offered in interchange with the repack date more than 15 months old, all car owners should set up journal-box repacking programs at repair tracks and shops which will provide for repacking all of their own cars on the home line at the expiration of 12 months, particularly those which are nearing the 15-month limit.

Because of varying conditions on roads as to the percentage of owned cars away from the home line, it will be necessary for each road to repack the journal boxes on a total number of cars during each 12-month period, system and foreign, at least equivalent to its own car ownership. By so

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE APRIL ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Chicago, Rock Island & Pacific	4	2,250	Passenger	Electro-Motive
Kansas City Southern	30[1]	1,500	Freight	Electro-Motive
Texas & Pacific	6[1]	1,500	Road switch	Electro-Motive
	8[1]	1,200	Switching	Electro-Motive
	8[1]	2,250	Passenger	Electro-Motive

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type*	*Builder*
American Refrigerator Transit Co.	500	40-ton refrigerator	Pressed Steel Car
Atchison, Topeka & Santa Fe	200	70-ton ballast	American Car & Fdry.
Atlantic Coast Line	6	50-ton air dump	Magor Car
Bangor & Aroostook	500[2]	40-ton refrigerator	Pacific Car & Fdry.
Canadian National	1,000	40-ton auto-box	Canadian Car & Fdry.
	100	30-ton flat	Canadian Car & Fdry.
Central of New Jersey	500	50-ton box	American Car & Fdry
Cudahy Packing Co.	50	40-ton refrigerator	Company shops
Chicago & Eastern Illinois	500	70-ton hopper	Pressed Steel Car
	500	50-ton hopper	Pressed Steel Car
Delaware, Lackawanna & Western	500	50-ton hopper	American Car & Fdry.
Grand Trunk Western	250	50-ton box	American Car & Fdry.
	250	70-ton hopper	American Car & Fdry.
	300	70-ton gondola	General American Trans.
	250	50-ton box	General American Trans.
Great Northern	1,000	70-ton ore	American Car & Fdry.
Kansas City Southern	500	70-ton hopper	Pullman-Standard
Lake Superior & Ishpeming	300[3]	70-ton ore	Bethlehem Steel
	100[3]	50-ton box	Pullman-Standard
Louisville & Nashville	100[4]	70-ton covered hopper	Pullman-Standard
Mather Stock Car Co.	50	40-ton refrigerator	Company shops
Minneapolis, Northfield & Southern	100[5]	50-ton box	Pullman-Standard
Missouri Pacific	100	50-ton pulpwood	Company shops
New York Central	1,000	70-ton gondola	Greenville Steel Car
	500	70-ton flat	General American Trans.
Pittsburgh & Lake Erie	1,000	70-ton gondola	Bethlehem Steel
Northern Pacific	1,000[6]	50-ton box	Company shops
	200	70-ton ore	Company shops
	50	Caboose	Company shops
Pennsylvania	250	70-ton covered hopper	Company shops
Southern Pacific	500	70-ton ballast	American Car & Fdry.
	100	70-ton gondola	Greenville Steel Car
Texas & Pacific	250[7]	70-ton gondola	Company shops
Virginian	300[8]	50-ton box	Pullman-Standard
Western Maryland	1,000	55-ton hopper	Bethlehem Steel
	70	70-ton flat	Greenville Steel Car

FREIGHT-CAR INQUIRIES

Baltimore & Ohio	1,000	70-ton gondola
	1,000	50-ton box
	500	70-ton covered hopper

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Lehigh Valley	2[9]	Rail diesel (RDC-2)	Budd Co.
Pennsylvania	64[10]	Passenger	Budd Co.

[1] With delivery of this motive power, all regular passenger trains on the system and all regular freight train operations west of Shreveport, La., will be dieselized, as well as all switching operations at important points in Texas and Louisiana.

[2] Delivery scheduled for the fourth quarter of 1951. Estimated cost, $4,500,000.

[3] The ore cars, to cost $1,740,000, are scheduled for delivery in August, 1952; the box cars, to cost $560,000, are scheduled for delivery in the second quarter of 1952.

[4] Approximate cost, $690,000. Delivery scheduled for mid-1952.

[5] Estimated cost, $560,000. Delivery scheduled for the third quarter of 1952.

[6] All cars to be completed in 1952. Delivery of materials will determine order in which cars are to be built.

[7] To be built in 1952.

[8] Estimated cost, $1,700,000. Delivery expected in the second quarter of 1952.

[9] Approximate cost, $300,000. The cars are scheduled to be placed in service late this summer between Hazelton, Pa., and Lehighton.

[10] These cars, for completely re-equipping the "Congressional" and the "Senator," will provide two 17-car trains between New York and Washington for the "Congressional" and two 15-car trains for the "Senator" for the Washington-Boston service. The "Congressional" equipment will include a new type parlor car with seven private rooms, each accommodating five passengers, designed for conferences or family groups. These trains will accommodate 827 passengers and provide dining facilities for 112 in a full-length twin-unit dining car, and in a coffee-shop car for coach passengers. There will be a mid-train lounge and an observation lounge car for Pullman passengers. Each set of equipment for the "Senator" will accommodate 767 passengers with dining and coffee shop accommodations for 92. The new cars are to be built "as rapidly as possible."

NOTES:

Chicago, Rock Island & Pacific.—The Rock Island has been authorized by its board of directors to purchase 46 diesel-electric locomotive units costing more than $7 million. With delivery of these units, the Rock Island said it will be "approximately 100 per cent dieselized." To be ordered are: Six 2,250-hp. passenger, 15 1,500-hp. double-control suburban service, and 25 1,500-hp. general-purpose units.

Star of NATIONAL TRADE-MARK standardized brushes



AZY

THE BRUSH GRADE FOR DIESEL-ELECTRIC TRACTION MOTORS

Broken brushes . . . . NO!

Shunt failures . . . . . NO!

Fine commutators . . YES!

plus SUPERB BRUSH LIFE!

● These statements are *facts*. Grade AZY brush is better than any brush ever applied to diesel-electric traction motors as proved by twelve million miles of rugged, on-the-job testing. Never before has there been a grade – GRADE AZY – combining physical strength with long life at high speeds without commutator wear.

This brush has a special, no-fray shunt cable. It has a unique, vise-tight shunt connection.

This brush is it, and you can get it, under National's unique standardization program, for the same low, flat price, whether you buy 1 box or 10,000 boxes. You get the best brush money can buy and you save money in the bargain. For complete information, write to National Carbon Company, A Division of Union Carbide and Carbon Corporation.

The terms "National", "Plytek" and "Eveready" are registered trade-marks of

NATIONAL CARBON COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

SLASH BATTERY COSTS IN HALF!

With the revolutionary new "Eveready" No. 1050 Flashlight Battery, you get these big exclusive features:

- More than twice as much light
- Whitest, brightest light available from a flashlight battery
- Half the cost for light output
- Leakproof – No metal can to leak or corrode
- Will not swell, stick or jam in a flashlight



Why? Because of "Eveready" No. 1050's exclusive "inside out" construction. Instead of being the container for the cell, the zinc electrode is on the inside to make the battery last longer, while the new outside carbon jacket makes the battery leakproof. *Order a supply of No. 1050's today.*

doing, there will eventually be but few cars in operation having journal boxes long overdue for repacking.

Unless the packing is in bad condition, loaded cars having journal boxes overdue for periodic attention should not be shopped solely for the purpose of repacking boxes, it being preferable to concentrate on empty cars.

The full cooperation of all car owners in this matter is earnestly requested, so as to insure fast operation of freight trains which are carrying all kinds of material of extreme importance at this time.

Emergency Specifications EM-601-51

The National production Authority of the U. S. Department of Commerce has placed controls on the consumption of new rubber in order to conserve the supply of rubber for the needs of national defense. The N.P.A.—M-2 contains provisions limiting the total new rubber and also limits the consumption of natural rubber. The need for greater use of synthetic and reduced use of natural rubber is immediate.

This matter has been considered jointly by the representatives of the Rubber Manufacturers' Association and the Committee on Specifications for Materials of the Mechanical Division. As a result of this consideration, a new emergency revision of Specification M-601 has been approved and is effective immediately.

Revision of other rubber goods specifications of the division is in course of preparation and emergency specifications will be issued shortly covering all of the specifications now shown in the 600 series in Sec. A of the Manual of Standard and Recommended Practice, except for air brake hose gaskets, for which specifications it is hoped there will be no necessity for any change. Every effort is also being made to preserve the present specifications of the manufacturers for gaskets used in air brake valves as well as in hose.

Truck Side Failures

In a circular dated March 21, the A.A.R. Mechanical Division again calls attention to the need for most careful inspection of cast-steel truck side frames before assembling in trucks ready for service. The specific suggestions advanced are to make sure that:

1—All secondhand truck side frames cast during and prior to 1926 and available for reapplication to interchange cars have been normalized, inspected and stamped as defined by current A.A.R. Interchange Rule 3, page 26.

2—Truck side frames in stock are stored in a manner which will prevent the accumulation of rust and corrosion, thus avoiding deterioration leading to possible future failures in service.

3—Where drain holes in bottom section of truck side frames on and off cars are found to be stopped up, the holes are reopened and the accumulated moisture and foreign matter cleaned out in order to avoid further deterioration by reason of corrosion.

Maintenance of Air Brakes

Air-brake Instruction Pamphlet No. 5039-4, Sup. 1, which governs the use of the single-car testing device, provides that the device arrangement must include a suitable feed valve in the air-supply line for the purpose of providing a constant air pressure during the various tests, also an efficient air filter in the supply line ahead of the feed valve.

In this connection, current reports from the A.A.R. Mechanical Inspection Department continue to show that many devices are in service though not yet equipped with the feed valve or the filter, or both. The A.A.R. Mechanical Division requests in a circular dated March 21 that immediate inspection be made of all single-car testing devices now owned, and that early necessary adjustments be made in accordance with standard requirements.

Gas-Turbine Locomotive Progress Reported

Substantial progress in the development of gas-turbine locomotives for American railway service was reported at the Midwest Power Conference sponsored by the Illinois Institute of Technology in co-operation with the other schools and technical societies in the middle west and held at Chicago April 4 to 6, inclusive. At the afternoon session on April 6, presided over by J. T. Rettaliata, dean of engineering of the Institute, four speakers included J. I. Yellot, director of research, Locomotive Development Committee, Baltimore, Md.; Alan Howard, Gas-Turbine Engineering division, General Electric Company, Schenectady, N. Y.; T. J. Putz, manager, Locomotive and Gas-Turbine Engineering, Westinghouse Electric Corporation, Philadelphia, Pa., and W. B. Tucker, Turbo

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

Freight Service (Data from I.C.C. M-211 and M-240)

Item No.		Month of December 1950	Month of December 1949	12 months ended with December 1950	12 months ended with December 1949
3	Road locomotive miles (000) (M-211):	28,693	29,704	346,515	390,869
3-05	Total, steam	20,025	15,066	211,799	152,954
3-06	Total, Diesel-electric	793	791	9,880	9,524
3-07	Total, electric	49,511	45,561	568,260	553,371
3-04	Total, locomotive-miles				
4	Car-miles (000,000) (M-211):	1,709	1,435	19,633	17,854
4-03	Loaded, total	812	869	10,139	10,154
4-06	Empty, total				
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):	47,097	45,552	577,555	611,875
6-01	Total in coal-burning steam locomotive trains	12,370	11,831	154,174	175,425
6-02	Total in oil-burning steam locomotive trains	55,102	42,031	598,948	435,635
6-03	Total in Diesel-electric locomotive trains	2,122	2,097	26,351	25,539
6-04	Total in electric locomotive trains	116,697	101,517	1,357,340	1,248,609
6-06	Total in all trains				
10	Averages per train-mile (excluding light trains) (M-211):	1.05	1.05	1.05	1.05
10-01	Locomotive-miles (principal and helper)	38.60	35.30	38.60	36.20
10-02	Loaded freight car-miles	18.30	21.30	19.90	20.60
10-03	Empty freight car-miles	56.90	56.60	58.50	56.80
10-04	Total freight car-miles (excluding caboose)	2,634	2,494	2,669	2,534
10-05	Gross ton-miles (excluding locomotive and tender)	1,233	1,110	1,224	1,138
10-06	Net ton-miles	32.00	31.50	31.70	31.40
12	Net ton-miles per loaded car-mile (M-211)				
13	Car-mile ratios (M-211):	67.80	62.30	65.90	63.70
13-03	Per cent loaded of total freight car-miles				
14	Averages per train hour (M-211):	16.60	17.10	16.80	16.90
14-01	Train miles	43,139	41,994	44,353	42,346
14-02	Gross ton-miles (excluding locomotive and tender)				
14	Car-miles per freight car day (M-240):	44.40	41.20	45.20	41.90
14-01	Serviceable	42.30	38.30	42.50	39.40
14-02	All	915	752	888	788
15	Average net ton-miles per freight car-day (000) (M-240)	35.90	50.10	40.80	50.00
17	Per cent of home cars of total freight cars on the line (M-240)				

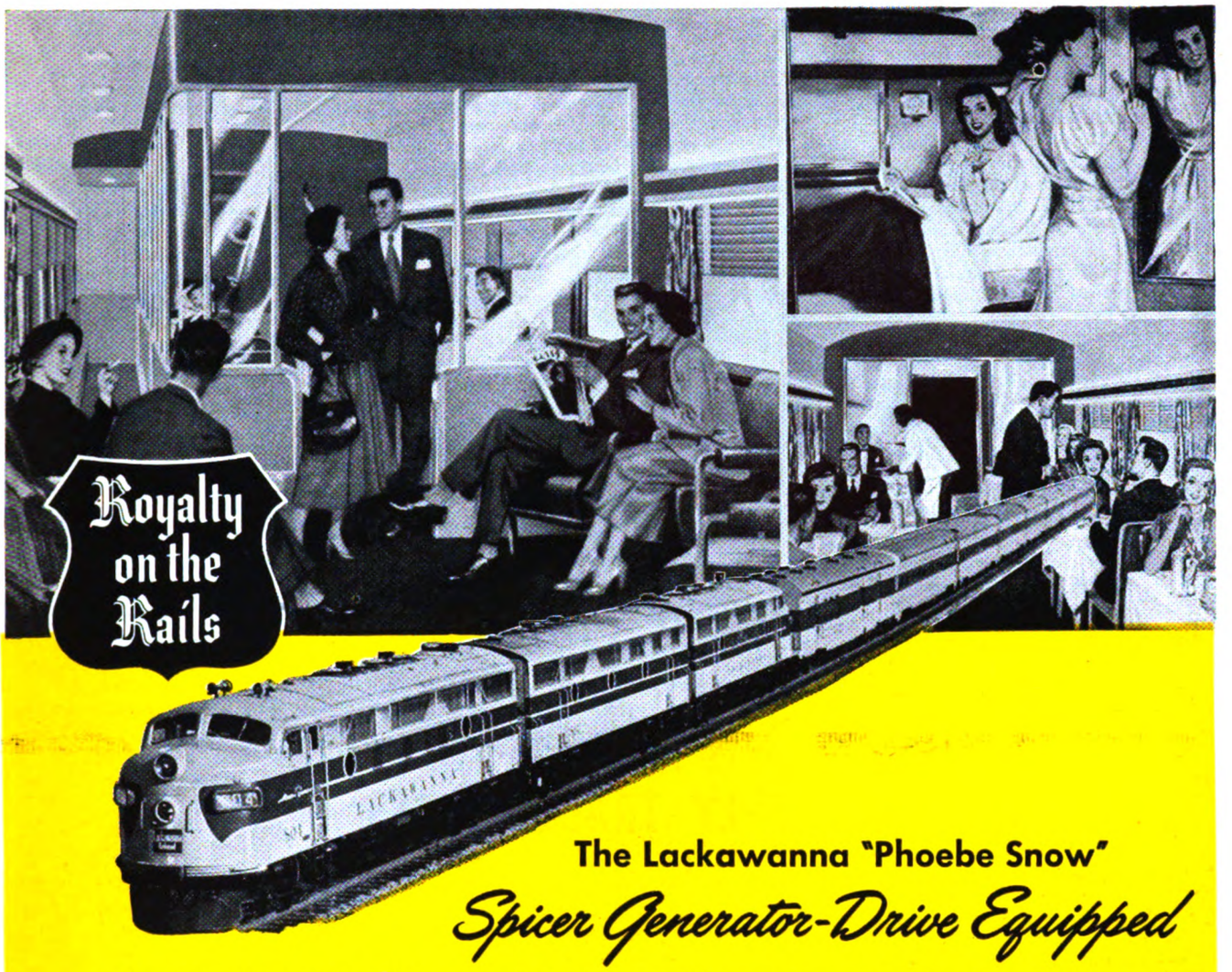
Passenger Service (Data from I.C.C. M-213)

3	Road motive-power miles (000):	13,139	14,757	141,521	184,580
3-05	Steam	15,948	14,032	176,722	153,232
3-06	Diesel-electric	1,780	1,751	19,385	19,862
3-07	Electric	30,867	30,539	337,629	357,788
3-04	Total				
4	Passenger train car-miles (000):	302,159	294,497	3,257,835	3,366,728
4-08	Total in all locomotive-propelled trains	74,086	79,263	740,281	967,839
4-09	Total in coal-burning steam locomotive trains	39,271	42,101	442,711	521,720
4-10	Total in oil-burning steam locomotive trains	170,209	153,888	1,866,810	1,659,387
4-11	Total in Diesel-electric locomotive trains	9.71	9.47	9.47	9.22
12	Total car-miles per train-miles				

Yard Service (Data from I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):	1,436	1,511	17,101	20,546
1-01	Steam, coal-burning	266	244	3,023	3,265
1-02	Steam, oil-burning	2,850	1,280	30,441	24,064
1-03	Diesel-electric[1]	4,580	4,063	50,894	48,190
1-06	Total				
2	Passenger yard switching hours (000):	67	83	701	1,066
2-01	Steam, coal-burning	15	14	164	183
2-02	Steam, oil-burning	262	240	2,776	2,536
2-03	Diesel-electric[1]	381	374	4,054	4,206
2-06	Total				
3	Hours per yard locomotive-day:	8.05	7.60	8.10	8.10
3-01	Steam	17.90	17.50	17.50	17.20
3-02	Diesel-electric	14.60	13.80	14.20	13.30
3-05	Serviceable	12.70	11.30	12.10	11.10
3-06	All locomotives (serviceable, unserviceable and stored)				
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.84	1.95	1.79	1.87
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.78	0.79	0.77	0.78

[1]Excludes B and trailing A units.



The Lackawanna "Phoebe Snow"

Spicer Generator-Drive Equipped

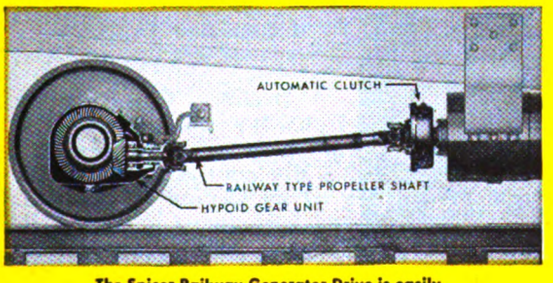
● Your first glimpse of one of the air-conditioned PHOEBE SNOW coaches will reveal a whole new array of comforts and conveniences: wide vista windows . . . individual reclining seats . . . oversized luggage racks . . . fluorescent lights . . . circulating ice-water . . . individual vanity tables in the women's lounge.

For sociability and relaxation, THE PHOEBE SNOW offers a smart new Observation-Lounge Car with deep-cushioned club chairs facing the large picture-windows—and with a separate Tavern section and Refreshment Bar.

The handsomely appointed new Dining Car of THE PHOEBE SNOW, with its wide panoramic windows, Venetian blinds and colorful drapes, provides a perfect setting for those delicious home-style meals for which the Lackawanna long has been famous.

For overnight travel between New York and Chicago, the westbound PHOEBE SNOW carries a modern, *all-private-room* Sleeping Car, containing 10 roomettes for single occupancy and 6 double bedrooms. Features of these rooms include individual controls for lighting, heating and air-conditioning . . . wardrobe and shoe lockers . . . full-length mirrors . . . and many other conveniences.

An imposing list of America's crack trains and streamliners rely upon Spicer equipment for electrical service of the highest efficiency. Write for literature giving complete details of the Spicer Railway Generator Drive.



The Spicer Railway Generator Drive is easily adaptable to old and new equipment

47 YEARS OF **Spicer** SERVICE

The Spicer Railway Generator Drive is manufactured, sold and serviced by

SPICER MANUFACTURING
Division of Dana Corporation
TOLEDO 1, OHIO

Power Development department, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Mr. Yellott said that experience to date indicates the goal of a practicable coal-fired gas-turbine locomotive is attainable and credited much of the success of recent tests to F. D. Buckley, manager, Research and Development division, Locomotive Development Committee Project, American Locomotive Company, Dunkirk, N. Y. Mr. Tucker showed how objectionable exhaust noise has been overcome in the Allis-Chalmers gas-turbine power unit. Mr. Howard described the progress to date with tests of the G.E. gas-turbo-electric locomotive on the Union Pacific which ordered 10 units of the same general type. Mr. Putz brought members up to date on the status of the Baldwin - Westinghouse gas-turbo-electric locomotive now in experimental general service on the Bessemer & Lake Erie.

R. V. Wright Essay Contest

The 1951 Roy V. Wright memorial essay contest of the New York Railroad Club involves $1,500 in prizes—one of $500 and 10 of $100 each—for the 11 best essays on the subject "Essential provisions of an adequate national transportation policy."

Although the designated subject was chosen because, as the announcement said, "there is probably no other transportation question to which the right answer, if made effective, would benefit so many people," contestants may write on other subjects. Those wanting to develop another topic are asked to get approval from C. T. Stansfield, executive secretary of the club, 30 Church Street, New York 7, to whom essays and other correspondence about the contest should be addressed. Completed essays must reach Mr. Stansfield no later than next October 1.

Essays in the contest, which is named for the late editor of the *Railway Mechanical and Electrical Engineer*, should be not less than 2,500, nor more than 7,000 words long. To be considered for prizes essays must contain internal evidence that the writer has familiarized himself with two books entitled "National Transportation Policy," by C. L. Dearing, and Wilfred Owen, and "Transportation Conditions and National Transportation Policy," 15 pamphlets containing testimony of railroad industry witnesses before the Senate Committee on Interstate and Foreign Commerce and published by the Association of American Railroads.

Miscellaneous Publications

ALUMINIZED STEEL.—Armco Steel Corporatin, Middletown, Ohio. 24-page booklet, "Armco Aluminized Steel." Describes the steel's aluminum surface, its heat and corrosion resistance, and outstanding heat reflectivity—80 per cent up to 900 deg. F. Applications in a wide variety of products illustrated or listed. Includes also data on mechanical and forming properties, available sizes and gages, and detailed recommendations for welding by various methods, brazing and finishing.

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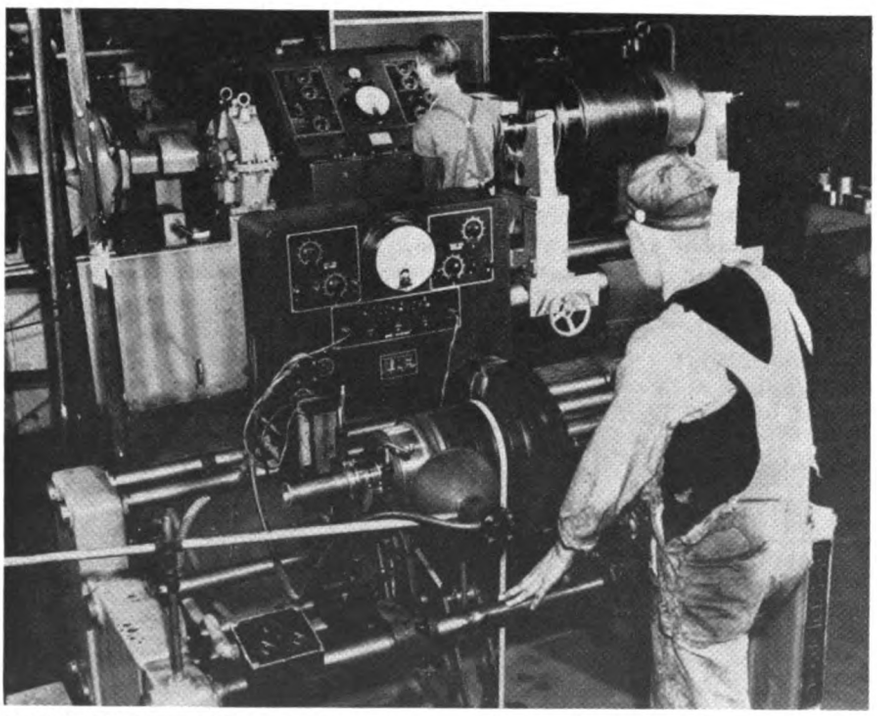
PRINCIPLES OF CENTERLESS GRINDING.—Cincinnati Grinders, Incorporated, Cincinnati 9, Ohio, 48-page, paper-bound booklet; illustrated. Intended to explain the several principles of centerless grinding which are entirely different from center-type grinding. Its nine chapters cover the basic design of a centerless grinding machine; methods and advantages of centerless grinding; work blades; wheels; truing the wheels; corrective adjustments—thrufeed and infeed work; how to economically grind small lots on a centerless; typical examples, and tables for estimating production of thrufeed work.

SUPPLY TRADE NOTES

TIMKEN ROLLER BEARING COMPANY.—*Paul Reeves* has been appointed director of sales of the Timken Company.

Mr. Reeves attended Staunton Military Academy and is a graduate of Carnegie Institute of Technology with a degree in Mechanical Engineering. He became associated with Timken in 1929 and after completing the engineering training course, served as sales engineer in the company's Chicago office. He was subsequently transferred to the San Fancisco, Cal., branch office where he was industrial district manager. In 1940 Mr. Reeves returned to the home office in Canton, Ohio, as sales promotion manager but when this country entered the war, he was put in charge of government priorities to handle contacts between the company and Washington. He was appointed advertising manager in 1943.

* * *



A Gisholt Balancing School has been inaugurated with classes limited to eight men—Lecture and discussion groups are supplemented by practical "on the job" instruction in balancing Diesel and electrical parts on equipment, as illustrated, at the plant, Madison, Wis.

◆

QUAKER RUBBER CORPORATION.—*J. R. Lewis* has been appointed assistant general sales manager of the Quaker Rubber Corporation, a division of the H. K. Porter Company. Mr. Lewis has been with Quaker since 1940, working successively as Philadelphia, Pa., district sales manager and assistant sales manager.

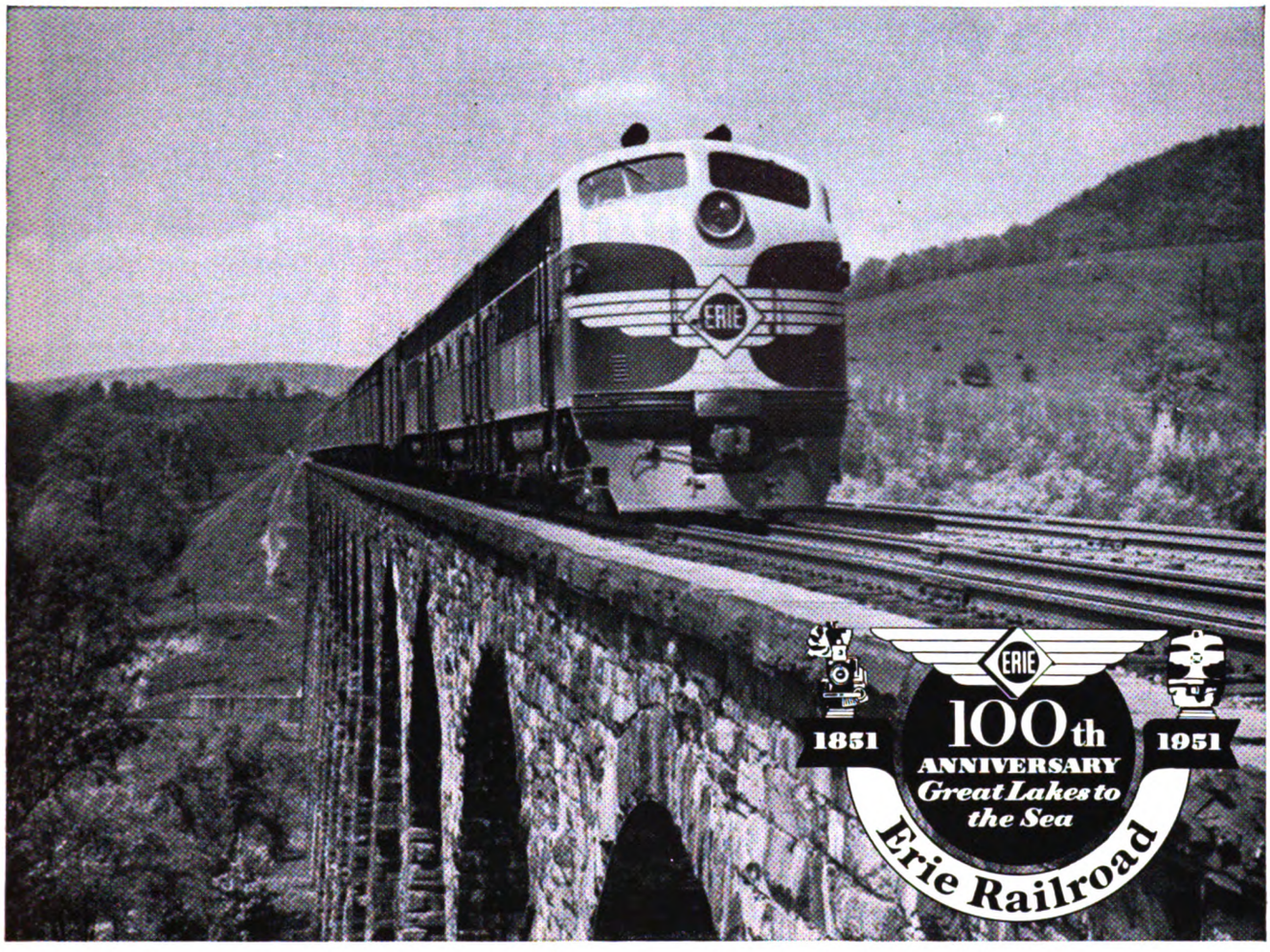
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DEARBORN CHEMICAL COMPANY.—The Chicago offices of the Dearborn Chemical Company have been moved from 310 South Michigan avenue to the Merchandise Mart Plaza, Chicago 54.

◆

PENNSYLVANIA SALT MANUFACTURING COMPANY.—The Pennsylvania Salt Manufacturing Company has formed a new sales department to serve industry and business

Esso Standard Oil Company Salutes the Erie Railroad...



in Partnership with Service and Progress for 100 Years

This month the Erie Railroad passes an outstanding milepost... its 100th Anniversary. This century of service is a truly great accomplishment... a record of constant enterprise and continuing development... a history of progress and public service. Congratulations to the Erie on a job well done!

The Esso Standard Oil Company is proud that dependable, high-quality Esso Railroad Fuels and Lubricants are being used by the Erie. Our continuing aim is to serve the needs of railroading with products that are "tailor made" to railroad specifications.

The Sign of QUALITY — ESSO — The Symbol of SERVICE

RAILROAD PRODUCTS

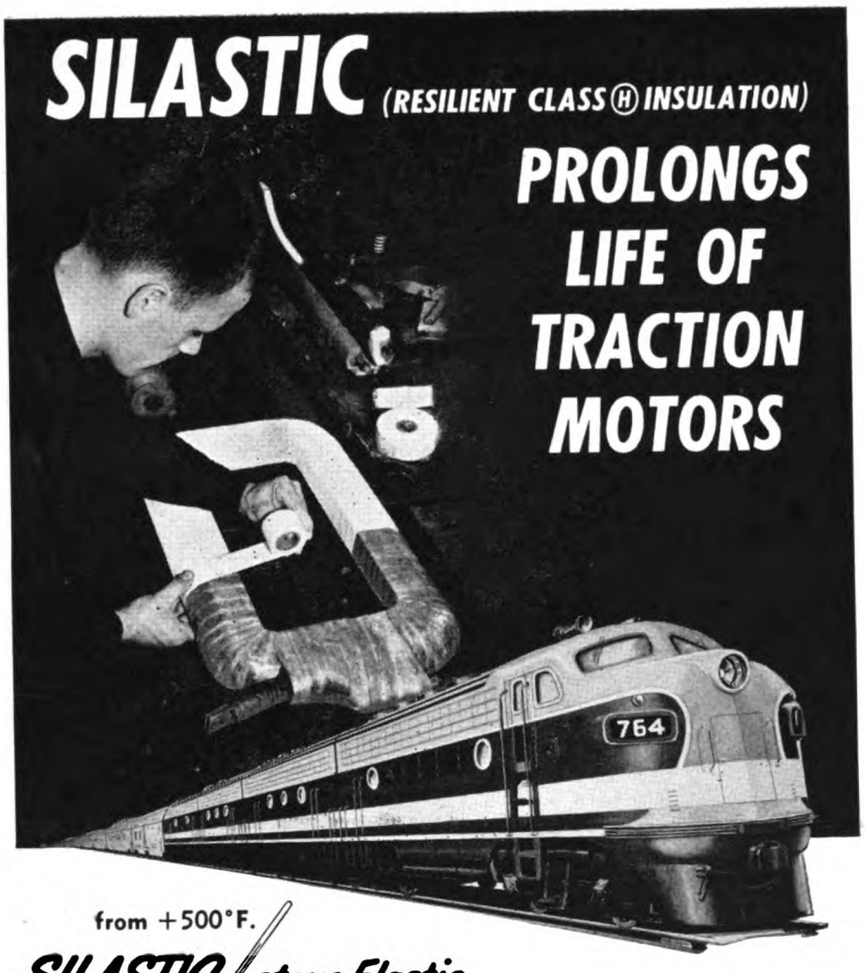
SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

Esso Railroad Products are backed by constant research and follow-up

SILASTIC (RESILIENT CLASS H INSULATION)

PROLONGS LIFE OF TRACTION MOTORS



from +500°F.

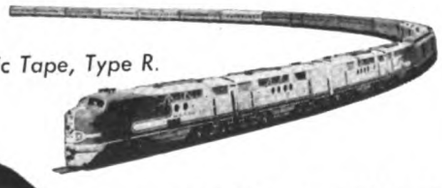
SILASTIC stays Elastic

to −100°F.

Now, for the first time since Benjamin Franklin tied a key to the tail of a kite, there's a rubbery insulating material that will withstand the heat generated in an overloaded motor. Available as Silastic Tape, Type R, these new insulating materials are easier to apply and form a longer lasting outer jacket than other kinds of insulation suitable for traction motor field coils.

Silastic Tape, Type R, vulcanizes to form a continuous void-free jacket that is moisture proof, stable and resilient at top Class H operating temperatures (180° C.), and highly resistant to oil and to both mechanical and electrical fatigue. Over 4200 main and interpole field coils insulated with Silastic Tape, Type R, are now in service on diesel-electric traction motors.

Many of these coils have been in service for more than 15 months with no failures reported even in the case of one locomotive that was suddenly thrown into reverse by a short circuited control panel. The cost is comparable to Class B coils; life expectancy is in the range of 10 to 1.



Write now for data on Silastic Tape, Type R.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

DOW CORNING SILICONES

Atlanta • Chicago • Cleveland • Dallas • Los Angeles • New York • Washington, D. C.
In Canada: Fiberglas Canada Ltd., Toronto • In Great Britain: Midland Silicones, Ltd.

in maintenance work including heavy duty cleaning of railroad equipment. The department, designated as the Maintenance Chemicals department, is headed by *Horace F. McIntyre,* a member of the Pennsalt organization since 1943 and formerly a sales representative, district sales manager



H. F. McIntyre

and then product supervisor in the Special Chemicals department. To the Maintenance Chemicals department has been assigned all sales and service work on Pennsalt products for maintenance, as differentiated from products used in manufacturing processes. Thus, Pennsalt's specialties for maintenance of railroad equipment, formerly handled by the Special Chemicals department, have been assigned to the new department.

◆

BULLARD COMPANY.—*Frank U. Hayes,* sales manager of the Bullard Company, Bridgeport, Conn., has been elected vice-president. Mr. Hayes, during his 16 years



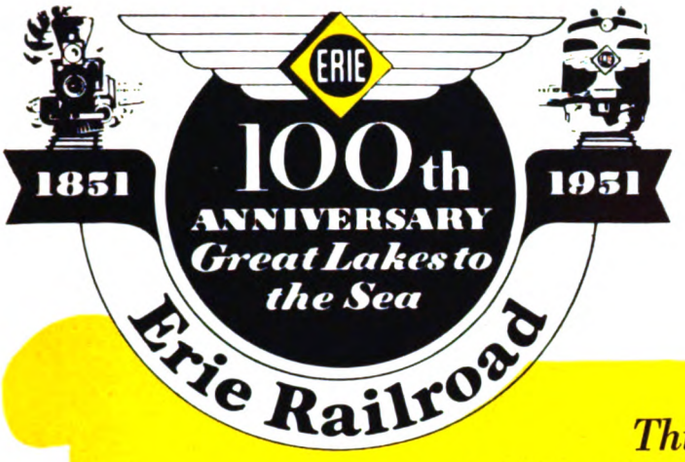
F. U. Hayes

with the company, has served in numerous capacities from the manufacturing phases up to his present status as vice-president and sales manager.

◆

FAIRBANKS, MORSE & CO.—*V. H. Peterson,* manager of the railroad division of Fairbanks, Morse, has been elected vice-president in charge of railroad sales.

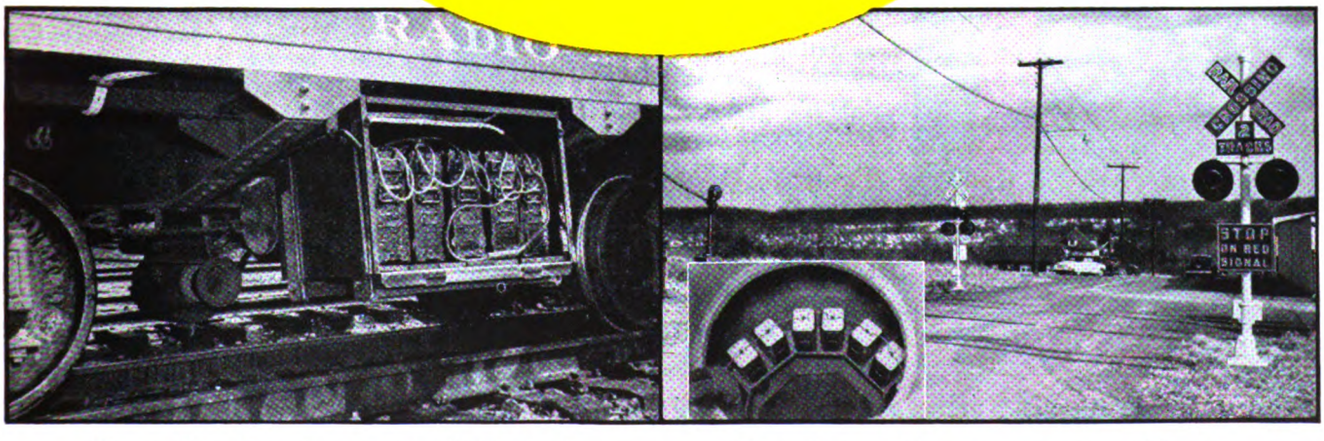
Mr. Peterson has been with Fairbanks, Morse & Co., since May of 1946. Prior to that time he was associated with the



This year marks the centennial of the completion of the New York and Erie Railroad, now the Erie, from Piermont on the Hudson River to Dunkirk on Lake Erie which provided the first rail connection "from the Great Lakes to the Sea."

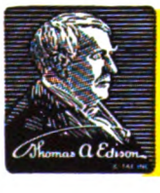
Today the Erie is a major trunkline in the East; extends all the way from the Port of New York to Chicago; serves "The Heart of Industrial America"; gives employment to 20,000 people; continually improves its capacity for service, its investment for improvements having amounted to $90,000,000 in the past 5 years.

Among these recent improvements was the adoption of radio train-communication and centralized traffic control. Our company is proud to have assisted the Erie in its application of electric power to these improvements as well as to earlier advancements including the lighting and air conditioning of passenger-train cars, the installation of automatic and highway crossing signals and many other signaling functions, two of which are illustrated here.



These caboose batteries were installed in 1948 after 22 to 25 years of car-lighting service.

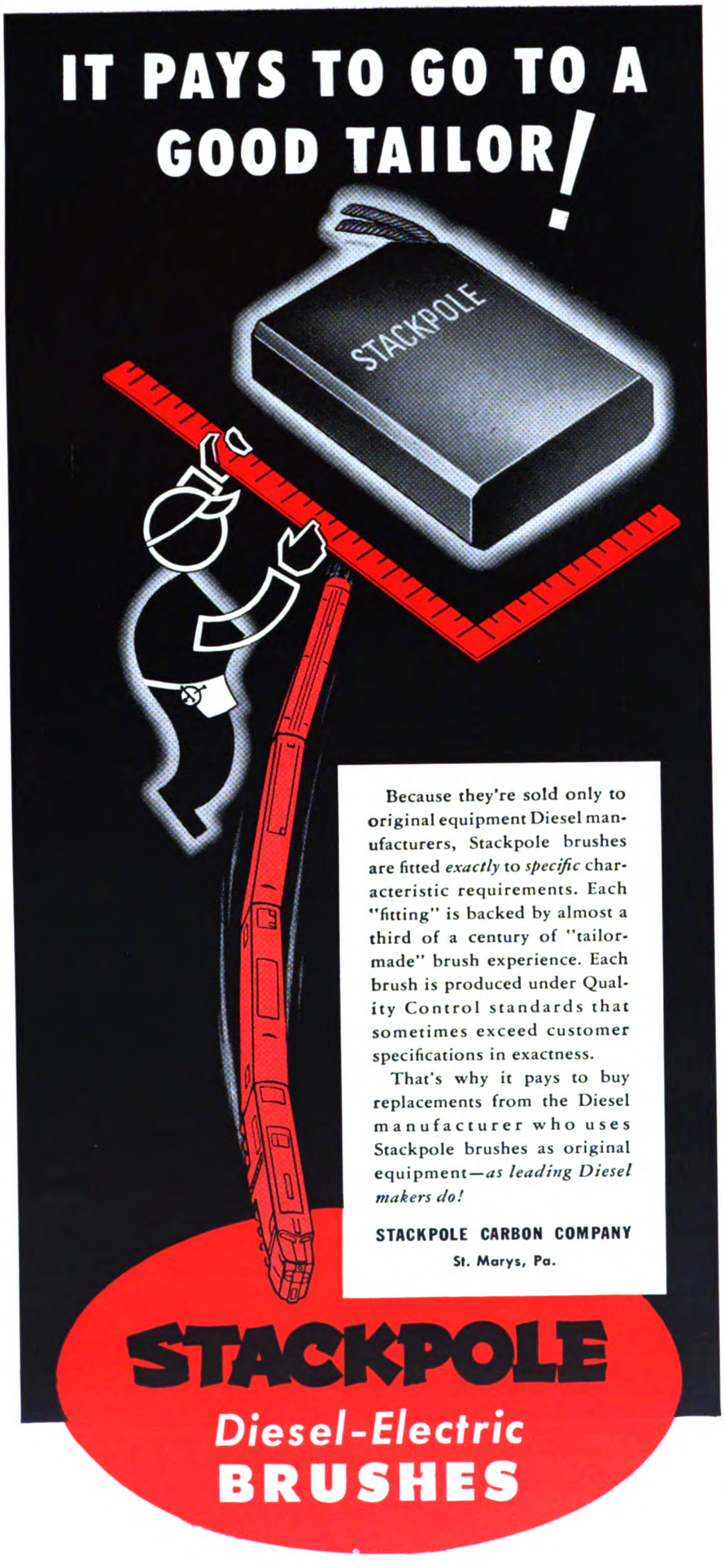
Edison Primary Batteries serve as stand-by power source for many Erie highway crossing signals.



THOMAS A. EDISON, INCORPORATED

Storage Battery Division • *Primary Battery Division*

WEST ORANGE, N. J. • BLOOMFIELD, N. J.



Baldwin Locomotive Works as assistant to the president and manager of Baldwin's New York office. After receiving his education in the public schools of Waterbury, Conn., Mr. Peterson first went to work as a draftsman for the Scovill Manufacturing Company of Waterbury. Through a scholarship he entered Rensselaer Polytechnic Institute at Troy, N.Y., where he received,



V. H. Peterson

a degree in mechanical engineering in 1925. He then entered the service of the Elliott Company, being engaged, successively, as sales engineer in the Pittsburgh, Pa., office and district manager of the Rochester, N.Y., and Washington, D.C., offices. In 1938 he went to Jeannette, Pa., as assistant to the president, where he coordinated the company's sales activities. Three years later he was elected a vice-president, with responsibility for all sales, advertising and service activities of Elliott's three plants In 1934 he became assistant to the president of Baldwin. He joined Fairbanks Morse in 1946 as manager of eastern sales, with headquarters at New York and shortly thereafter became manager of the combined diesel locomotive and railroad divisions at Chicago.

◆

BALDWIN-LIMA-HAMILTON CORPORATION.—*Henry Barnhart* has been appointed general manager of the Lima plant and *J. F. Connaughton* as assistant general manager of the Lima-Hamilton division of the Baldwin-Lima-Hamilton Corporation, Lima, Ohio. Mr. Barnhart, also a vice-president, has been associated with Baldwin-Lima-Hamilton and predecessor companies since 1928. He was appointed general sales manager in 1936 and vice-president in 1944. Mr. Connaughton, also special assistant to *Walter A. Rentschler*, vice-president in charge of the division, has likewise been with the corporation since 1928.

The corporation has closed its offices at 120 Broadway, New York. All sales activities in the New York area will be coordinated in the company's offices at 60 E. 42nd street, New York.

◆

TURCO PRODUCTS, INC.—*L. H. Moulton*, vice-president and national sales director of Turco Products, has retired. *D. T. Buist* succeeds Mr. Moulton as national sales director. *Stewart B. Van Dyne* has been

MORE AMPERES CAN RIDE THESE CABLES



You can do yourself and our country a service by installing Simplex-ANHYDREX XX Cables wherever you need to replace high voltage power cable.

Here's why. You can crowd more amps into the same size copper when it is insulated with Simplex-ANHYDREX XX. That's how you save copper. Of course your cables will run hotter but that's all right with Simplex-ANHYDREX XX insulation. This insulation is built to withstand 75°C. to 80°C. (167°F. to 176°F.), depending on operating conditions.

Simplex-ANHYDREX XX Insulated Cables can be used underground, directly in the earth, or in ducts, or they can be used overhead as aerial cables. The special Simplex neoprene jacket protects these insulated conductors from sunlight, oil, acids, alkalies, etc.

Want to know more about this versatile high temperature, high voltage power cable insulation that really combats moisture and water? Then return the coupon. No obligation, of course.

Simplex-ANHYDREX XX is a product of Simplex Research

SIMPLEX WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.
GENTLEMEN: PLEASE SEND A COPY OF BOOKLET 1009A TO:

NAME_____ TITLE_____
COMPANY_____
STREET_____
CITY_____ STATE_____

FOR YOUR MANY
"GREASE CHASING" Jobs
stock
SUPER MAGNUSOL



Where there's greasy, oily dirt to remove . . . put Super Magnusol to work. It cleans in record time, without costly "elbow grease," and with complete safety for all surfaces.

- Save $10 to $12 per engine room every time you clean. Just spray on a mixture of one part Super Magnusol and six parts safety solvent, and let it soak in. Then flush off with water. You clean engine surfaces and all the floor area by the same method.
- Use the same mixture for cleaning out engine pits. Super Magnusol takes the "cling" out of greasy dirt, whatever it is.
- Clean greasy concrete floors by the same method. There is no danger of fire when you use Super Magnusol. No fumes . . . no toxicity.
- Clean engine trucks and underbodies with the Super Magnusol solution. Just spray it on and flush it off.

There are a number of ways you can convince yourself as to the job Super Magnusol can do for you. We'll gladly send a Magnus representative to give you a demonstration. You can have a supply to try out yourself on the Magnus 30-Day Trial Basis. You can ask us for the names of railroads now using Super Magnusol, and see what they think of it. The main point is—it's worth looking into!

Railroad Division
MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.
In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS
AND
CLEANING EQUIPMENT
Representatives in all principal cities

appointed administrative assistant, *D. T. Miller* coordinator of sales. The latter are newly-created positions. *J. Hart* has been appointed manager of the Metal Processing Sales division. Mr. Hart will act as special sales representative and technical advisor to the metal processing and general manufacturing fields.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*Herbert E. McCandless*, vice-president in charge of circulation for the



H. E. McCandless

Simmons-Boardman Publishing Corporation, has retired. Mr. McCandles was born on January 18, 1890, in New York City, where he began his business career in 1905 in the banking field. From 1911 to 1917 he was associated with a New York public utility company. He served in the United States Army from late 1917 to 1919. Mr. McCandless joined Simmons-Boardman in 1920 and in 1928 was appointed assistant to the president in charge of circulation. He was elected a vice-president in August, 1943.

◆

GENERAL STEEL CASTINGS CORPORATION.—*Pierre O. Wood*, sales engineer for General Steel Castings Corporation, has been appointed assistant manager of service, with offices at Granite City, Ill.

After receiving his B. S. degree in mechanical engineering at Purdue University,

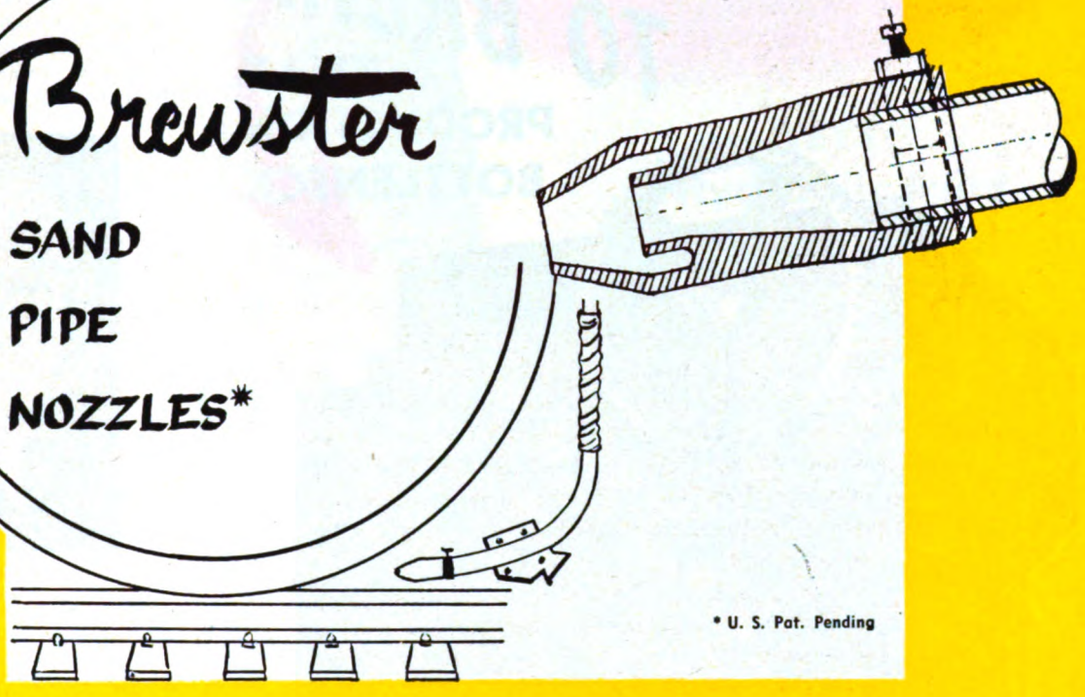


Pierre O. Wood

Mr. Wood worked in the shops of the St. Louis-San Francisco, completing an ap-

Brewster

SAND PIPE NOZZLES*



* U. S. Pat. Pending

Now in use by leading railroads

1 — *DIRECTS SAND to point of contact*

2 — *MINIMUM sand flow*

3 — *FEWER sand box refills*

4 — *BETTER adhesion between wheel and rail*

5 — *NO WATER can enter pipe by capillary attraction*

6 — *SIZES TO FIT both 1" or 1¼" pipe*

PLEASE SPECIFY:

No. 888-1 — for application to 1" delivery pipes

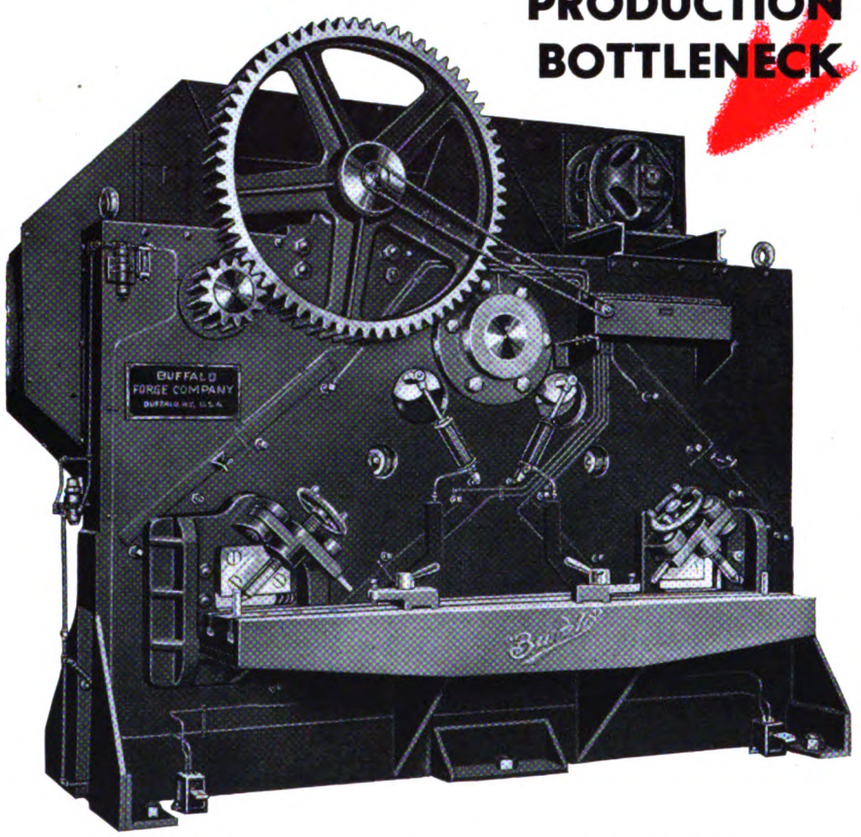
No. 888-1¼ — for application to 1¼" delivery pipes

MORRIS B. BREWSTER CO., INC.

8 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

"Buffalo" DOUBLE END ANGLE and BAR SHEAR

TO BREAK THAT PRODUCTION BOTTLENECK



THIS 1 RUGGED MACHINE

- CUTS ROUNDS UP TO 4⅜"
- CUTS SQUARES UP TO 4"
- SHEARS UP TO 8 x 1⅛" ANGLES
- SHEARS UP TO 6 x 2½" FLATS

. . . as well as beams, channels and other structurals, using suitable knives. Here is a fast, versatile machine to keep the fabrication end of your production moving! And you can "push" it for years and years—its electrically welded steel frame gives it lasting rigidity and strength. Five sizes to choose from. WRITE FOR BULLETIN 310-C.

BUFFALO "Buffalo" FORGE COMPANY
174 Mortimer St. Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

prenticeship as machinist. He joined General Steel Castings in January, 1929, as an inspector at its Commonwealth plant, later serving in the engineering and sales departments. In 1936 he became service engineer, and in 1945 returned to the sales department as sales engineer.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*Ellis W. Test*, assistant to president of Pullman-Standard Car Manufacturing Company, has retired.

Mr. Test received his engineering degree from the University of Michigan in 1906,



Ellis W. Test

when he began his career as a shop apprentice and draftsman on small railway cars with Fairbanks, Morse & Co., at Three Rivers, Mich. He was associated with the Haskell & Barker Car Co., prior to that company's acquisition by the Pullman Company in 1922, at which time Mr. Test came to Chicago as assistant to the vice-president. Later he also served as chief engineer, and in 1924 when Pullman became Pullman Car & Manufacturing Corp., he continued as assistant to vice-president. He was appointed assistant to president of Pullman Standard Co. in 1935.

◆

GENERAL MOTORS CORPORATION.—*Frank U. Naughton, Jr.*, has been appointed manager of the Eastern sales division of the *Hyatt Bearings division* of General Motors, to succeed the late W. L. Iliff. Mr. Naughton has been sales engineer for Hyatt since 1924, serving in the Philadelphia, Pa., New England and southeastern territories.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*H. Raymond Benson*, formerly New England district maintenance supervisor of the Westinghouse Electric Corporation, has been appointed manager of the transportation department, at district headquarters in Boston, Mass.

Mr. Benson, an electrical engineering graduate of Northeastern University, joined the transportation sales department of Westinghouse in the New England district in 1924. He was appointed district maintenance supervisor in 1939.

◆

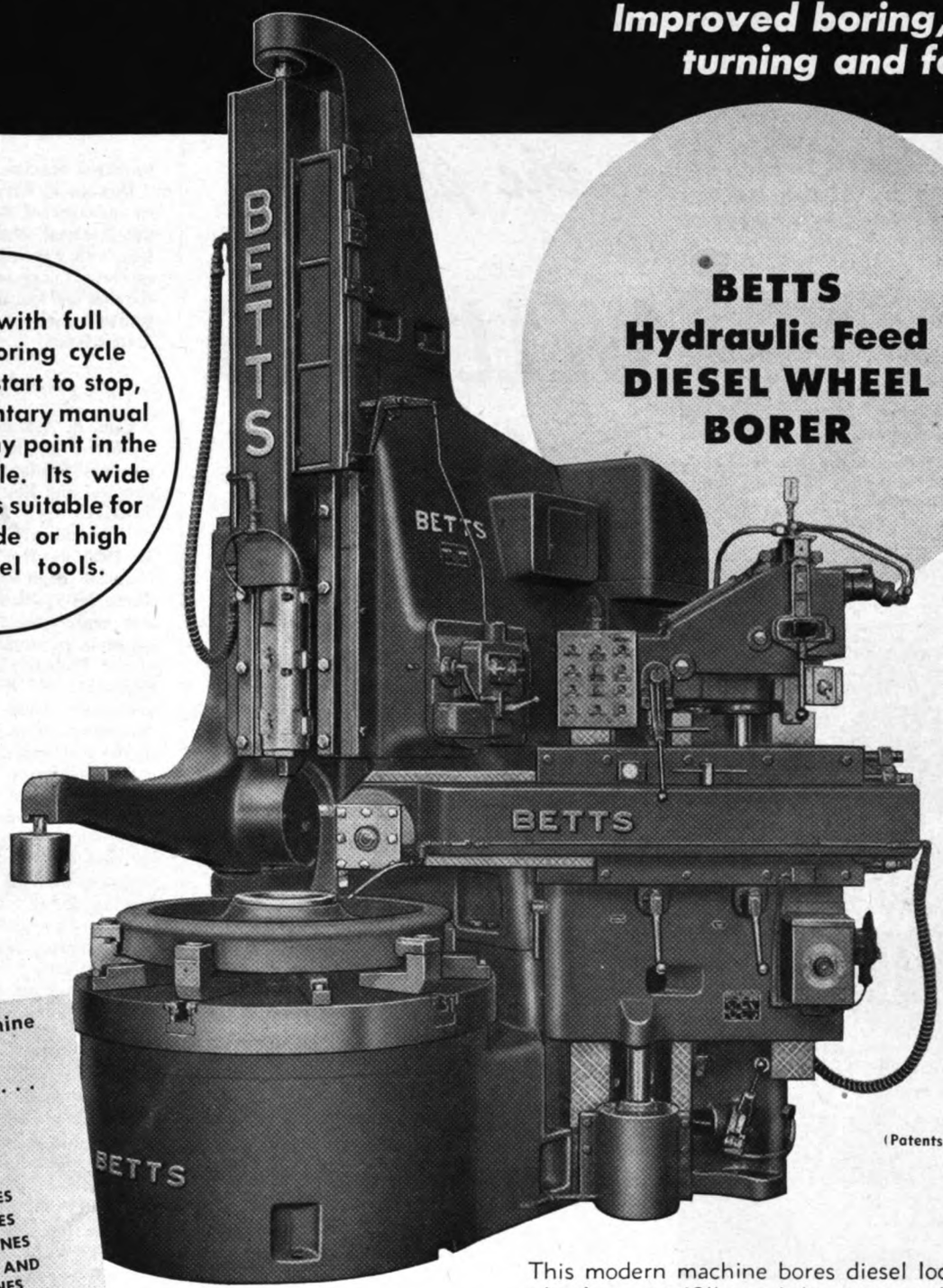
AIR REDUCTION COMPANY.—The Air Reduction Company will construct a new plant at Calvert City, Ky., costing upwards of

FOR DIESEL LOCOMOTIVE WHEELS

Improved boring, hub turning and facing

Designed with full automatic boring cycle from loaded start to stop, and supplementary manual operation at any point in the automatic cycle. Its wide speed range is suitable for either carbide or high speed steel tools.

BETTS Hydraulic Feed DIESEL WHEEL BORER



(Patents Pending)

This modern machine bores diesel locomotive wheels up to 48" tread diameter, and passenger or freight car wheels down to 30" tread diameter. The hydraulically operated side head, for turning and facing the hubs, has feed and rapid traverse vertically and horizontally with supplementary hand feed. Write for complete information on this advanced machine designed to reduce costs while speeding up wheel production.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

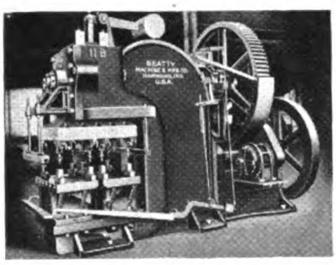
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

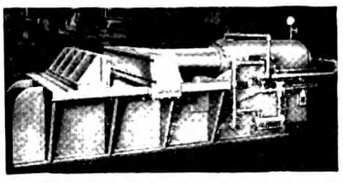
ROCHESTER 10, NEW YORK



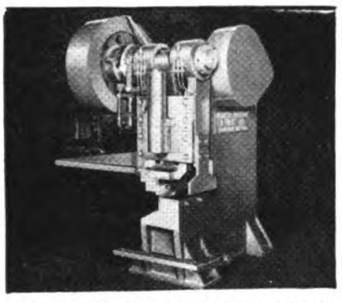
BEATTY No. 11-B Heavy Duty Punch widely used in railroad industry.

YOU NAME the problem

WE'LL BUILD the answer



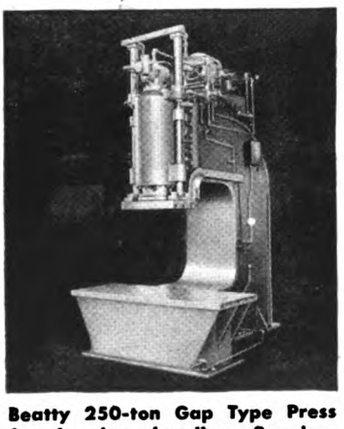
Beatty Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.



Beatty Single End Bar Shear available in capacities up to 300 ton.

If you have a heavy metal working problem, the odds are that a BEATTY engineer can provide the answer. That's true because BEATTY engineers have designed and built so many special machines that no problem is completely new to them.

Our experience in many fields qualifies us to design and build heavy metal working tools that will speed your production, reduce your fabricating costs. There is a better way to handle most production problems, and our specialty is to help you find that better way.



Beatty 250-ton Gap Type Press for forming, bending, flanging, pressing.



HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

$10,000,000. Construction will begin next July 1 and operations are expected to start by January 1, 1953. The new plant will be operated by the *National Carbide Company*, under direction of *Russell T. Lund*, operations manager of Carbide's Louisville, Ky., Keokuk, Iowa, and Ivanhoe. Va., plants

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.

DONALD F. KITTREDGE has been appointed manager of sales, Railway division, of the National Malleable & Steel Castings Co., with headquarters at New York. He succeeds ELLSWORTH H. SHERWOOD, whose election as assistant vice-president, sales, Railway division, was announced in the March issue.

Obituary

EARL A. AVERILL, at one time managing editor of the Railway Age Gazette, Mechanical Edition (now the Railway Mechanical and Electrical Engineer), died on Tuesday, April 3. Mr. Averill was born at Richland, N.Y., on August 13, 1878. In 1900 he received the degree of mechanical engineer at Cornell University where he specialized in railway mechanical engineering. He began his railroad career in the summer of 1899 in the shops of the Philadelphia & Reading (now the Reading), at Reading, Pa., and upon graduation from Cornell went to West Burlington, Iowa, where he was employed in the mechanical department of the Chicago, Burlington & Quincy. Four years later Mr. Averill joined the staff of the Railway and Engineering Review of Chicago. On January 1, 1906, he became associated with the American Engineer and Railroad Journal and on April 1, 1910, was appointed managing editor. He continued as managing editor of the Railway Age Gazette, Mechanical Edition, when the American Engineer and Railroad Journal was incorporated with that paper upon its purchase by the Simmons-Boardman Publishing Company in 1911. On March 1, 1914, he resigned to become engineer of operation of the Standard Stoker Company. Upon the organization of the Locomotive Feed Water Heater Company in 1916, Mr. Averill, one of the organizers, became vice-president of that company. From March, 1921, when the Locomotive Feedwater Heater Company was taken over by the Superheater Company, until July, 1940, Mr. Averill was engaged in the service department of the Superheater Company.

◆

JOHN W. FOYLE, who for many years served as first vice-president of the Gustin-Bacon Manufacturing Company, Kansas City, Mo., died at St. Mary's Hospital in that city on February 27. Mr. Foyle was born at Parsons, Kan., October 4, 1879. Mr. Folye was educated at St. Mary's (Kan.) College, and served in World War I with the rank of major. He was employed on the Missouri-Kansas-Texas, the Wabash, the Chicago, Indianapolis & Louisville and the Erie prior to joining Gustin-

(Continued on page 110)

An informative message from Chrysler Corporation

NEW DESIGN FREIGHT CAR TRUCK DELIVERS HIGHER EFFICIENCY

CHRYSLER engineering research has always included vehicle "ride" —the design and construction that give superior riding qualities in the vehicles we make.

Revolutionary advances in cars and trucks have come out of this fundamental research. And our engineers became interested in applying these important principles of vehicle ride to serve American railroads and shippers.

In collaboration with railroads, we developed an advanced design Railroad Freight Car Truck which affords greater protection to goods in transit, even in capacity loading.

It is built with balanced suspension which absorbs both lateral and vertical track-originated shocks. It is efficient to operate and easy to maintain. Its durability, dependability and reduced wear have been demonstrated in several years and many miles of railroad freight and head-end service.

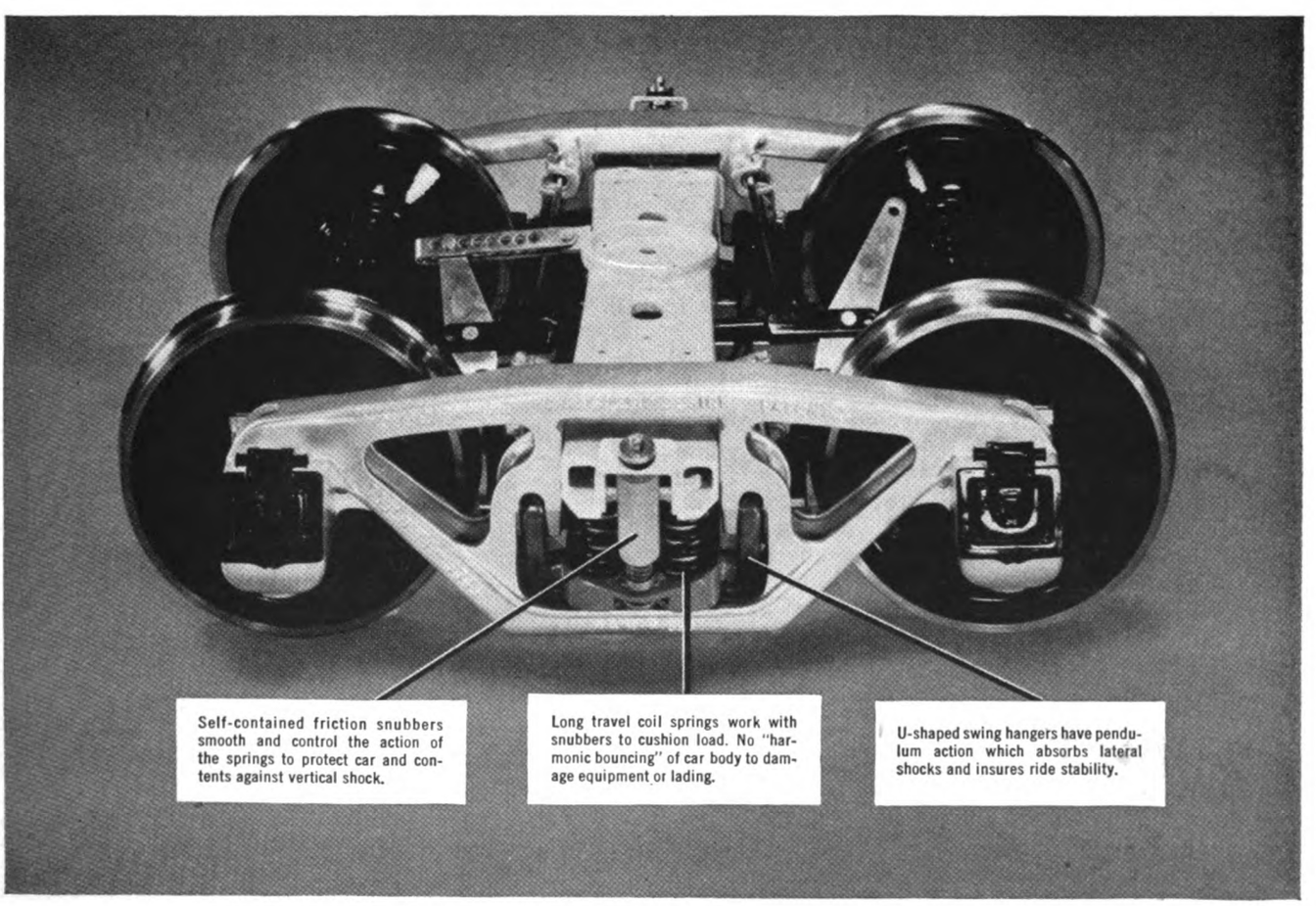
All segments of the transportation industry are vital to our nation's mobility. The development of this railroad truck stems from a basic automotive engineering advance, translated to the field of railroad transportation.

Chrysler Corporation felt that the best interests of the railroads would be served by extending to established manufacturers of railroad equipment the opportunity to produce this advanced unit. It is through such channels that it is available to American railroads.

Symington-Gould Corporation, Depew, N. Y., has been licensed to manufacture and sell the Chrysler Design Railroad Freight Truck. The self-contained friction snubbers—an important feature of the truck—are of Chrysler design and are manufactured and sold by the Houde Engineering Division, Houdaille-Hershey Corporation, Buffalo, N. Y.

The new trucks are already in use by many railroads on their freight cars, and they have been adopted for the General American-Evans Damage Free Box Car.

CHRYSLER CORPORATION



STOP RUST



Available in many colors, aluminum and white.

RUST-OLEUM can help you control rust—to cut your maintenance costs—and to avoid needless rust losses. It stops rust effectively—and prolongs the useful life of rustable metal so that costly replacements can be deferred years longer than previously could be expected.

Railroads find RUST-OLEUM the practical answer to many rust problems. Its tough, pliable film gives excellent protection to rolling stock, bridges, tanks, metal buildings, signal equipment and other properties.

CUT YOUR MAINTENANCE COST

Rescue metal that has already started to rust. RUST-OLEUM can be applied *even* over metal already rusted —usually without sandblasting or the use of chemical cleaners. Simply scrape and wire-brush to remove rust scale and loose rust. Then apply RUST-OLEUM by brush, dip, or spray. It stops the rust, and promptly dries to a firm, pliable, rust resistant protective coating.



Write for your copy of the RUST-OLEUM Railroad Catalog



RUST-OLEUM CORPORATION

2590 Oakton Street **EVANSTON, ILLINOIS**

Bacon in 1913 as a salesman, handling railway supplies. A few years later he became vice-president. His interest remained largely in the railroad department of the company, but when his health began to fail slightly three years ago, Mr.



John W. Foyle

Foyle gave up many of his railroad duties to devote his time to construction of the new Fairfax plant. He was a life member of the Purchases & Stores Division of the Association of American Railroads.

◆

JOSEPH J. EDWARDS, vice-president of the O. M. Edwards Company, died recently while on a business trip in San Antonio, Tex. Mr. Edwards, born in Johnstown, N. Y., on January 8, 1887, was the son

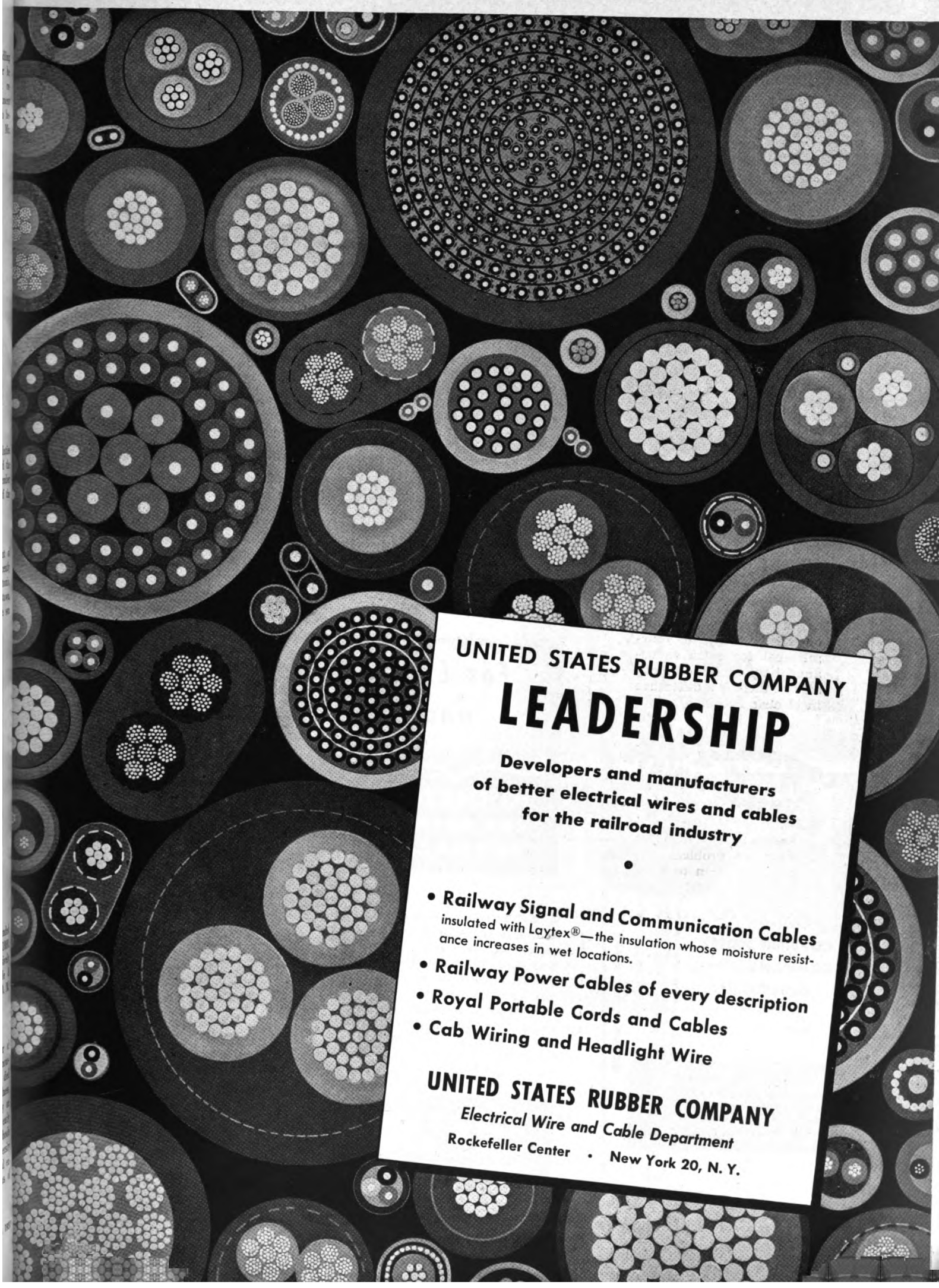


Joseph J. Edwards

of Oliver Murray Edwards, who founded the O. M. Edwards Company in 1888. Early in his career he worked successively for the Southern and the Louisville & Nashville, after which he joined the O. M. Edwards Company.

◆

PAUL TRAEGER, formerly manager of the service department of the Simmons-Boardman Publishing Corporation, died on March 26, after an extended illness. Mr. Traeger was born in Germany on January 4, 1891. He received his early education in New York public schools and was a graduate of Cornell University in 1913 with a degree in mechanical engineering. During summer vacations of


UNITED STATES RUBBER COMPANY
LEADERSHIP
Developers and manufacturers
of better electrical wires and cables
for the railroad industry
•
• Railway Signal and Communication Cables
insulated with Laytex®—the insulation whose moisture resistance increases in wet locations.
• Railway Power Cables of every description
• Royal Portable Cords and Cables
• Cab Wiring and Headlight Wire
UNITED STATES RUBBER COMPANY
Electrical Wire and Cable Department
Rockefeller Center • New York 20, N. Y.

built for
LONGER USE

Reduce costly delays and bottleneck breakdowns, eliminate need for a large supply of replacement parts. Equip your shops with Coffing Quik-Lift electric hoists. They're built to *stay on the job* — to give you continuous operation in the toughest day-after-day work.

backed by
BETTER SERVICE

Prompt, efficient Coffing service, with immediate shipment of parts further protects you against costly down time.

Put one or two Quik-Lifts **on the job. Prove to yourself that for extra endurance backed by efficient service there *is* a difference in electric hoists.**

COFFING Quik-Lift ELECTRIC HOISTS



Write
COFFING HOIST COMPANY
Danville, ILL.
for Bulletin
H5E

Hoist-Jacks • Safety-Pull Ratchet Lever Hoists • Mighty-Midget Pullers • Spur-Geared Hoists • Differential Chain Hoists • Load Binders • I-Beam Trolleys.



Paul Traeger

1911 and 1912. Mr. Traeger worked with the New York Central on third rail construction. From 1913 to 1915 he served as a special apprentice at the Harmon, N. Y., shops and, in the latter year, entered the road's electrical engineering department. He left in 1916 to join the Aetna Explosive Company, Emporium, Pa., and worked successively as master mechanic and mechanical engineer. Mr. Traeger became associated with Simmons-Boardman in 1918 working as advertising copy writer. In 1927 he was appointed assistant manager, service department and in 1931 manager of the department. On October 10, 1949, he received a leave of absence because of ill health.

◆

DAVID C. BALL, organizer and chairman of the board of directors of Oakite Products, Inc., died on March 23 at his home in Lake Placid, N. Y. Mr. Ball, who was 93 years old, organized the Oakly Chemical

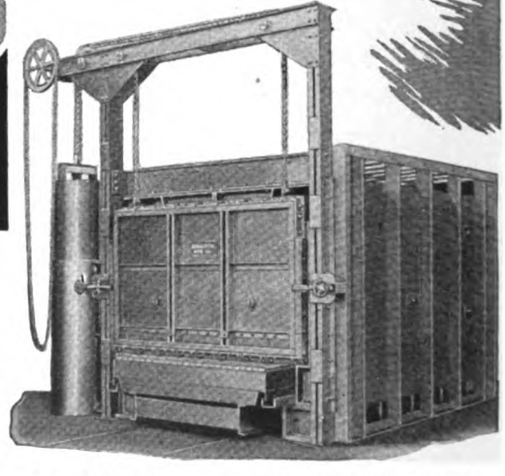


David C. Ball

Company in 1909 and later became its president. In 1926 the name of the company was changed to Oakite Products, Inc. Mr. Ball became chairman of the board of directors in 1949.

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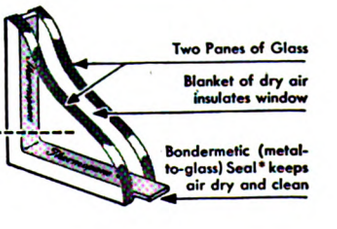
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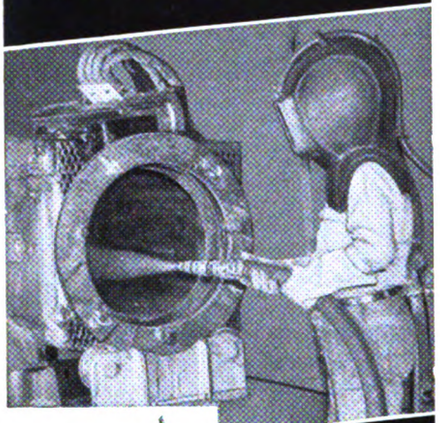
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PERSONAL MENTION

General

ERIC G. ECKLUND, superintendent of motive power, of the Rutland, has been appointed general superintendent.

J. W. GANN, master mechanic of the Chicago, Rock Island & Pacific at Armourdale yards, Kansas City, Kan., has been appointed superintendent motive power, first mechanical district, with headquarters at Chicago.

H. M. HOFFMEISTER has been appointed engineer of tests of the Missouri Pacific Lines, with headquarters at St. Louis, Mo.

S. R. TILBURY, fuel supervisor Eastern Lines, of the Atchison, Topeka & Santa Fe at Topeka, Kan., retired on March 1 after 38 years of service.

L. H. KUECK, assistant chief mechanical officer of the Missouri Pacific Lines at St. Louis, Mo., has retired.

PHILIP H. HATCH, general mechanical superintendent of the New York, New Haven & Hartford at New Haven, Conn., has retired after 28 years of service with that road.

KENNETH CARTWRIGHT, chief mechanical engineer of the New York, New Haven & Hartford at New Haven, Conn., has been appointed general mechanical superintendent at New Haven.

CARL A. LOVE, general master mechanic of the Louisville & Nashville, has been appointed an assistant superintendent of machinery, with headquarters at Louisville, Ky.

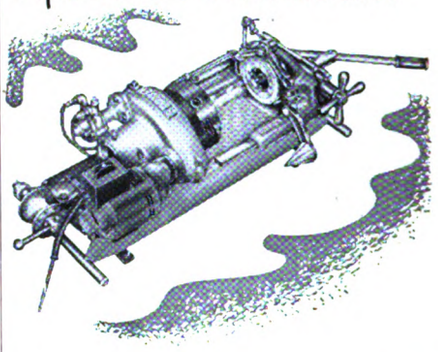
HENRY E. WHITENER, who has been appointed superintendent motive power and rolling equipment of the Central of New Jersey at Elizabethport, N. J., as announced in the March issue, was born on September 5, 1895, at Hickory, N. C., where he attended high school and Lenoir College. He



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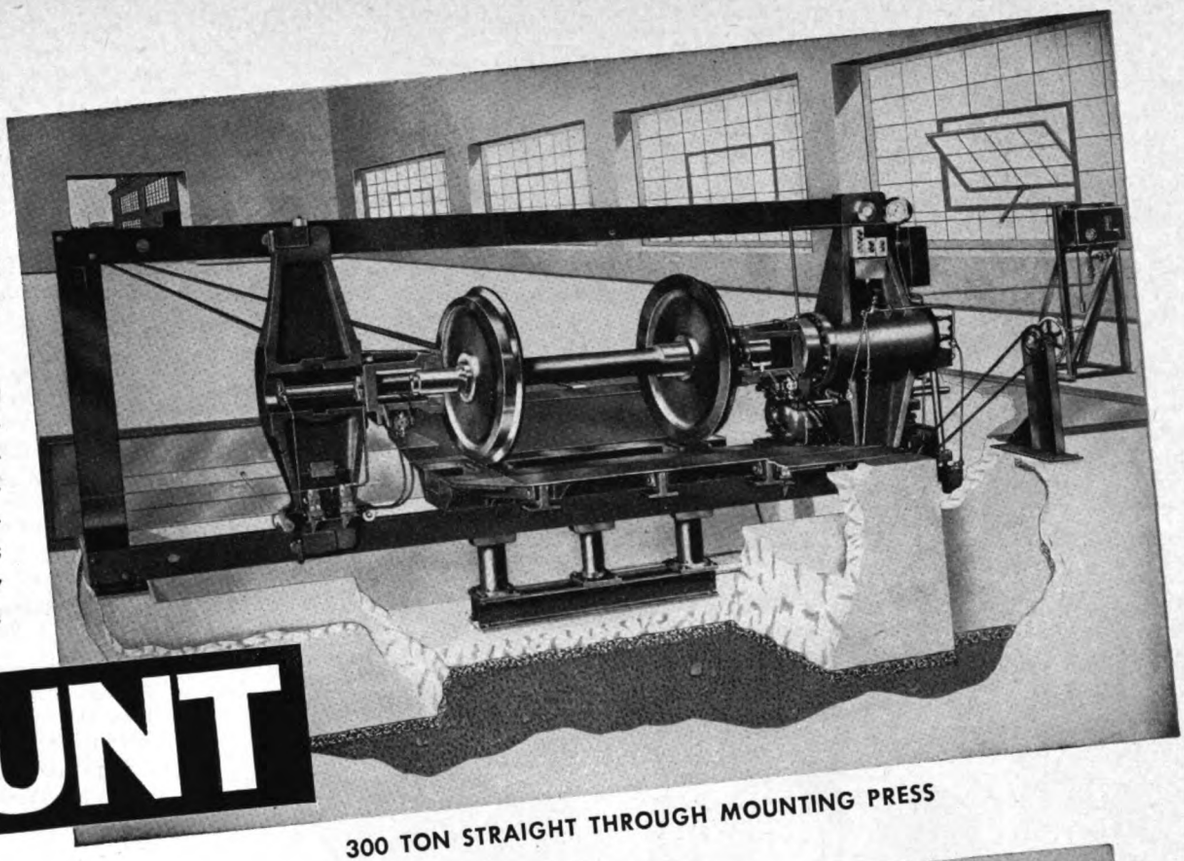
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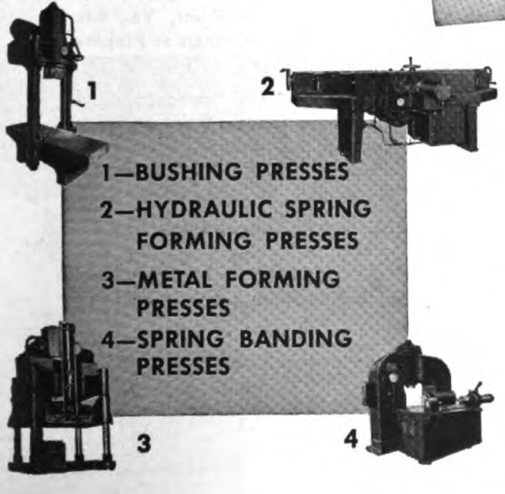
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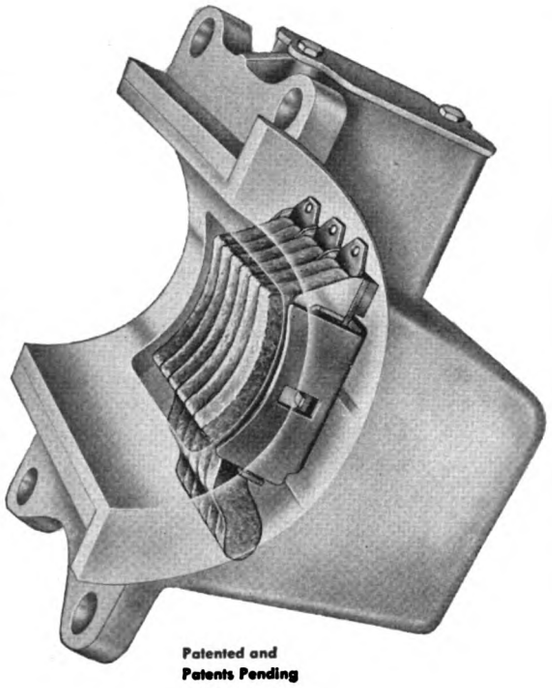
9-K-12

entered railroad service on October 1, 1913, with the Carolina & Northwestern at Hickory as an apprentice. During 1916 and 1917 he was with the Southern as a machinist at Spencer, N. C. He subsequently served in the United States Army Air Corps. In 1919 he joined the Baltimore & Ohio as foreman at Fairmont, W. Va., becoming general foreman at Parkersburg, W. Va., in 1920 and assistant master mechanic at Holloway, Ohio, in 1922. He was transferred to Cumberland, Md., in 1926 and from 1927 to 1930 was shop superintendent for the Chicago Great Western at Oelwein, Iowa. From 1930 to 1937 he was foreman for the Central of New Jersey at Jersey City, N. J., and in 1937 became general locomotive inspector of the Reading at Reading, Pa. In 1939 he was appointed shop superintendent of the C.N.J. at Elizabeth, N. J., and in 1942 master mechanic at Jersey City.

E. C. MEINHOLTZ, engineer of tests of the Missouri Pacific Lines at St. Louis, Mo., has been appointed mechanical engineer, with headquarters at St. Louis.

GEORGE J. HIGGINS, superintendent of the Readville (Mass.) shops of the New York, New Haven & Hartford, has been appointed assistant general mechanical superintendent.





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Car Department

B. F. ORR, superintendent of the Beech Grove, Ind., car shop of the New York Central, after 45 years with the company, has retired.

SYLVESTER H. KAYS, general foreman car repairs of the Southern at Chattanooga, Tenn., has been appointed general foreman car repairs at Princeton, Ind.

JOSEPH F. CLEMO, assistant general foreman car repairs of the Southern at Birmingham, Ala., has been appointed general foreman car repairs at Meridian, Miss.

NORMAN A. PASSU, supervisor, car construction, of the Southern Pacific, has been appointed engineer, car construction, with headquarters at San Francisco, Cal.

Master Mechanics and Road Foremen

T. J. SHERRIDAN, acting master mechanic, Chicago division, of the Pennsylvania, has been appointed master mechanic of the same division.

R. J. PARSONS, assistant master mechanic of the New York Central at Albany, N. Y., has been appointed master mechanic at Avis, Pa.

P. J. BIGGAN, master mechanic of the Chicago Rock Island & Pacific at Goodland, Kan., has been appointed master mechanic of the Missouri-Kansas divisions with headquarters at Armourdale, Kan.

E. ROSS HANNA, master mechanic of the Missouri Pacific at Nevada, Mo., has retired after 26 years of service with the M.P. Lines.

C. B. CAMP, general foreman locomotive department of the Chicago, Rock Island & Pacific at El Reno, Okla., has been appointed master mechanic of the Western division, with headquarters at Goodland, Kan.

Shop and Enginehouse

V. L. MINNICK, foreman of the Norfolk & Western at Lynchburgh, Va., has been appointed general foreman at Williamson, W. Va.

C. S. PATTON, JR., general foreman of the Norkfolk & Western at Williamson, W. Va., has been appointed general foreman, locomotive department, at the Roanoke, Va, shops.

J. P. ROUDABUSH has been appointed assistant foreman in the machine shop of the Norfolk & Western at Roanoke, Va.

A. T. PARNELL, electrician supervisor of the Southern at Pinners Point, Va., has been appointed general foreman at Pinners Point.

JAMES C. WADDLE has been appointed general foreman of the Southern at Chattanooga, Tenn. Mr. Waddle was previously general enginehouse foreman at Chattanooga.

DUANE A. GORMAN, assistant to the superintendent of the South Louisville, Ky., shops of the Louisville & Nashville, has been appointed assistant superintendent of the shops.

JUNE, 1951

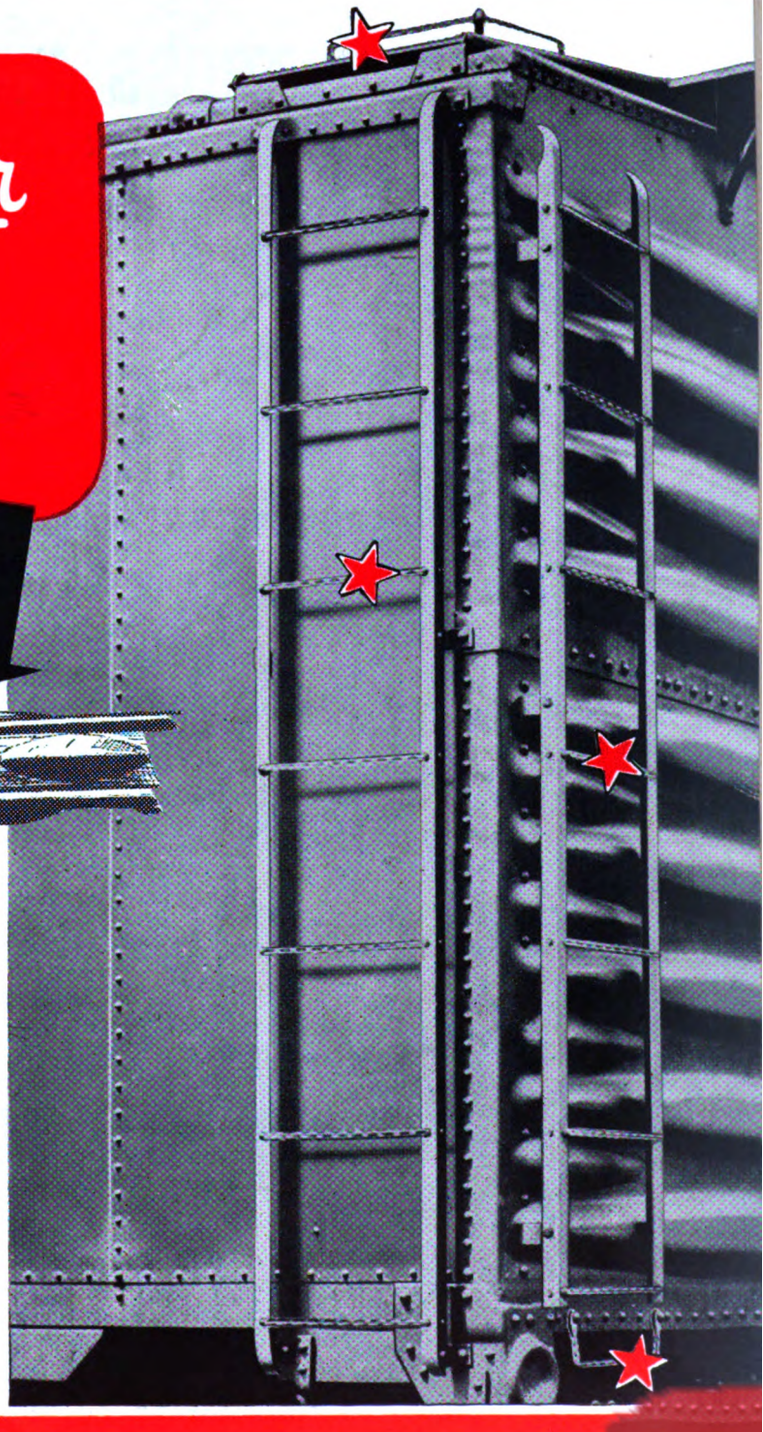
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VOLUME 125

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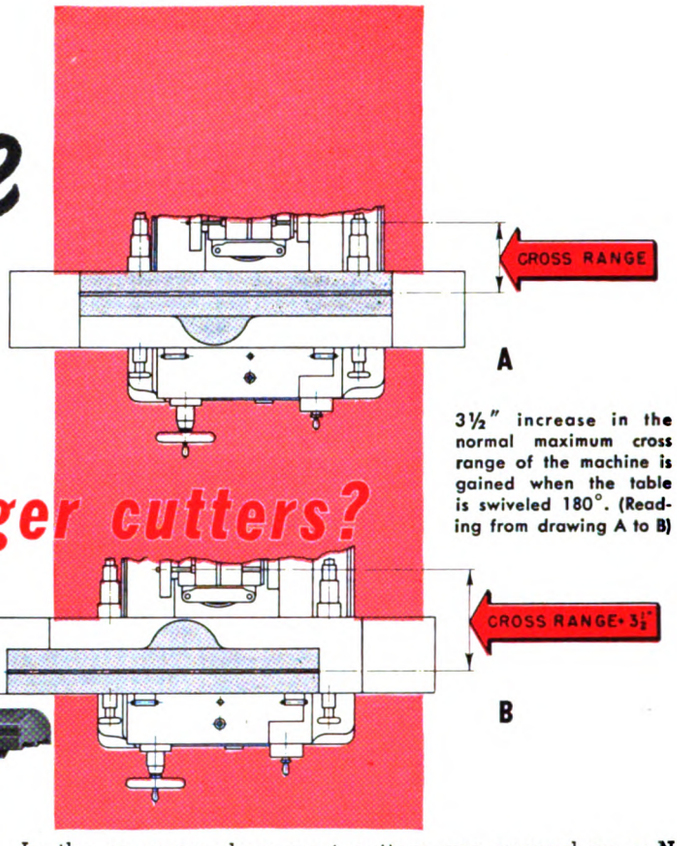
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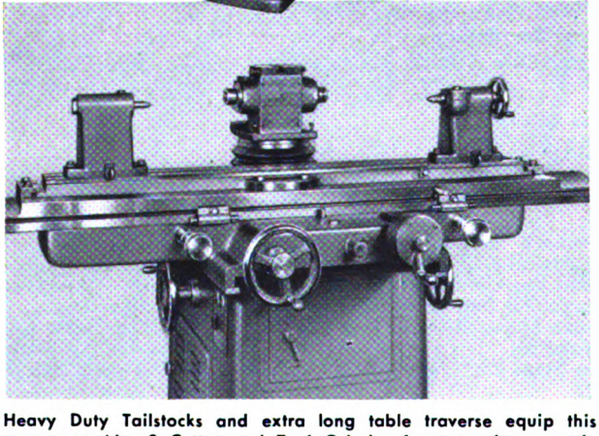
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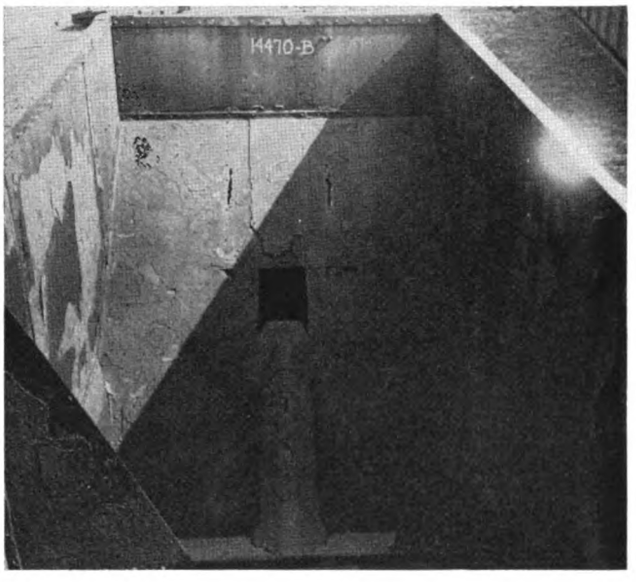
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RAILWAY Mechanical and Electrical Engineer

RUST— How to Combat It by Proper Design*



Materials having alloys which experience has proved will delay the destructive effects of corrosion can be made to last still longer if the designer uses good judgment

By H. Malcolm Priest†

MANY people are keenly aware of the fact that corrosion is the source of serious economic loss and waste of natural resources. Others are actively concerned with the reduction of these losses and much research has been devoted to the fundamental aspects of the problem. Enlightened design can make an effective contribution, although it can seldom be expected to eliminate the deleterious effects of corrosion. Nevertheless, design should always seek to control or minimize these effects.

The steel industry has sought one approach to the corrosion problem through the chemical composition of the steel. Beginning with structural carbon steel, it has developed other grades, with increasing resistance to corrosion, that progress through copper steel, high-strength, low-alloy steels, to the stainless steels.

The increased corrosion resistance is obtained by the addition to the steel of alloying elements which at the same time increase the cost. Consequently, the final selection of a steel depends upon a balance between the desired corrosion resistance and willingness to pay the extra cost involved. Until recent years, copper steel had been used almost exclusively in railroad car construction when added corrosion resistance was essential. A further advance was provided by some of the high-strength steels whose superior corrosion resisting properties, accompanied by the added advantage of greater strength with only a moderate cost premium, have given these steels an increasing acceptance in the railroad, as well as in many other fields.

Various familiar means have long been utilized for protecting steel against the ravages of corrosion. The most common are painting, galvanizing, tinplating, or the application of asphaltic and other compounds. The function of these methods is to interpose essentially neutral substances between the steel and the corroding media. At best, they but delay the inevitable attack unless an unbroken protective coating can be continuously maintained.

Designing engineers have often endeavored to obtain longer life from structures by adding an arbitrary amount to the thickness of material to allow for corrosion, or by specifying some minimum thickness regardless of strength requirements. In other cases, where strength is a secondary factor, the thickness has been determined on the basis of the rate of corrosion as found from experience with the type of structure under consid-

* A paper presented at the Railroad Corrosion Conference sponsored by the International Nickel Company, Inc. at Wrightsville Beach, North Carolina, May 1-3, 1951

†Manager, Railroad Research Bureau, United States Steel Company

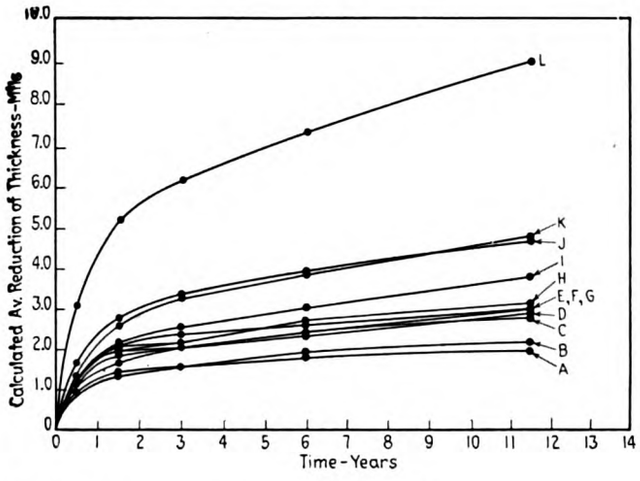


Fig. 1—Time corrosion curves for steels in industrial atmosphere at Kearny, N. J.

eration. Such methods as these are not without merit but they do not go to the real root of the trouble. They are an acceptance of existing conditions rather than a remedy such as may be obtained through improved design. There is greater warrant for them when the possibilities of design have been exhausted.

There is a wider realization today that construction details play a role in corrosion, whenever they provide conditions that accelerate the action. The control of these construction details lies very largely in the realm of design, which is the specific subject of this discussion. Design is concerned more with the fact than with the theory of corrosion.

Corrosion is defined as "destruction of a metal by chemical or electro-chemical reaction with its environment." The amount of corrosion depends on the composition of the metal and the environment. The effects on various grades of steel corroded on test racks in an industrial atmosphere are plotted in Fig. 1. Steel *L* is a structural steel with a low residual copper content. Steel *K* is a structural copper steel. The remainder represents the high-strength, low-alloy steels made by various manufacturers in 1938.

It is noticeable that after three years of exposure the steels corroded at essentially linear rates. During the first three years the protective rusts are being developed and the corrosion rates are non-linear and relatively high. It is also noteworthy that the better grades of steel acquire a uniformly protective rust film earlier than does structural steel *L*. The rust films on steel are much more protective when they are developed under alternate wet and dry conditions than under continuously moist conditions.

On test racks, specimens wet by dew and rain become periodically dry and may remain so for a considerable percentage of the time. According to the generally accepted electrochemical theory of corrosion, steel can corrode only when there is at least a film of moisture on the metal surface. Therefore, it behooves us to so design our steel structures that the surface remains wet for minimum lengths of time.

Whenever the protective rust coating is removed by erosion or cracked by bending, a fresh metal surface is exposed to corrosion. The rate of loss is again the same as indicated at the left-hand end of the chart in Fig. 1. Thus it is readily seen why mechanical action is often conducive to accelerated corrosion.

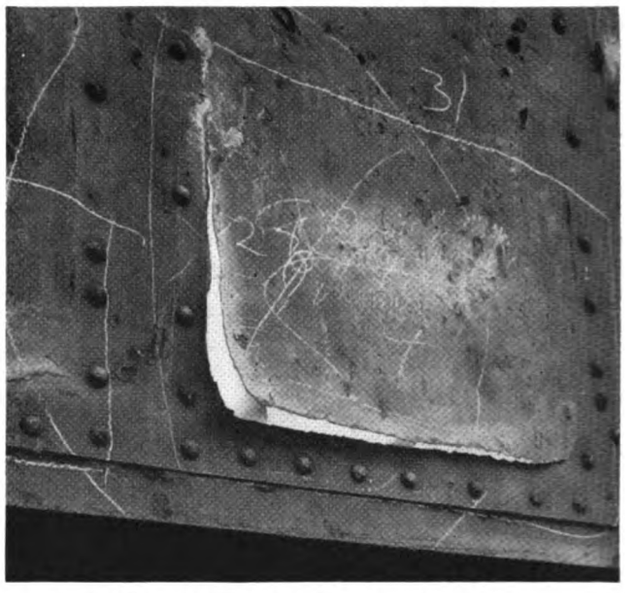


Fig. 2—Side sheet corroded through along vertical leg of side-sill angle and vertically along inside side stake. Sheet gaping open about 2½ in.

Most technological advances have been made through the careful and painstaking accumulation and study of data obtained from observations and tests. Not the least of these advances have been contributed by failures. There is a curious reluctance at times to discuss failures, as though they were like skeletons in a closet. In reality, they have been the source of some of the most valuable information and have contributed immeasurably to the progress of science and the improvement of many arts.

An excellent way to approach the subject of designing against corrosion is to observe actual conditions and to seek explanations of any unusual rates of corrosion. Inevitably, we shall deal with failures,—normal failures, they might be called—and shall examine them only with a view to extending the time before they occur.

Hopper Car Design

Let us begin with the ordinary hopper car—a type of car in which problems of corrosion are numerous. Railroad mechanical people are all too familiar with the condition illustrated in the photograph of Fig. 2. The first question that comes to mind is—"Why did this failure occur?"—and before any answer can be given, we must gather more facts about conditions.

At the conclusion of an investigation of the service life of various steels in hopper cars, the side sheets from several cars were removed, cleaned and gaged for thickneed, with the results depicted in Fig. 3-A. From the top bulb angle to the side sill there was an increasing loss which parallels, in a general manner, the increase in horizontal pressure of the lading of coal, shown in Fig. 3-B. The outward pressure creates bending stresses in the side sheet and also augments the frictional or erosive action of the lading during the unloading operation. Both of these mechanical actions vary directly with the pressure, and their effect might be expected to be more pronounced toward the side sill.

We need to look closely at the detail arrangement of the structure at the side sill where the most common construction is that shown in Fig. 4-A. The significant feature to note is the ledge or shelf formed by the top

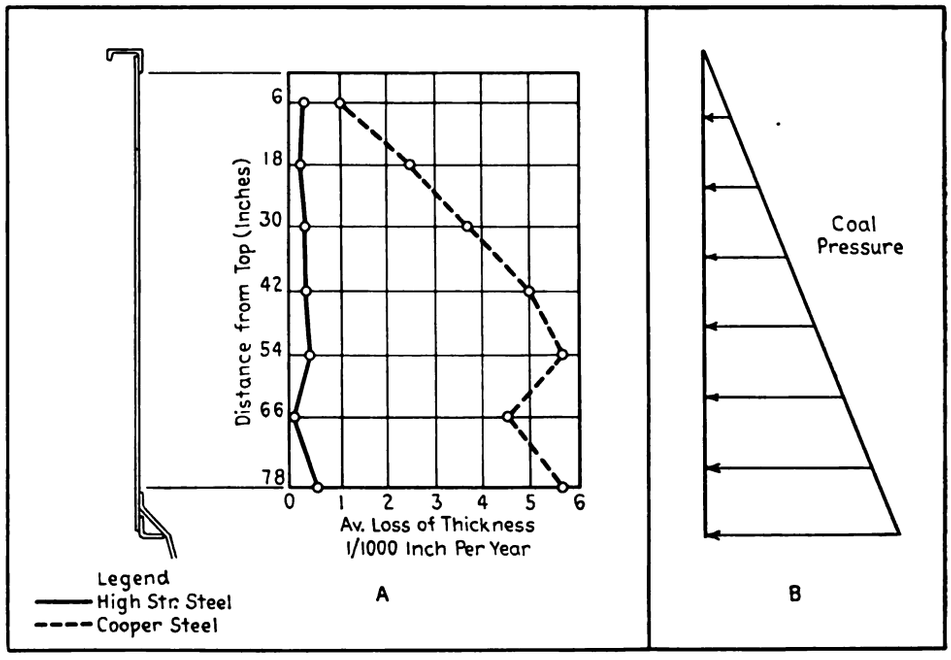


Fig. 3 — Corrosion loss in side sheets

edges of the sill angle and the hopper sheet. This ledge retains dirt and powdered coal that trap moisture and coal leachings. Clearly, there are conditions in the region of the side sill that can and do contribute to the failure locally when other portions of the sheet, only a few inches away, are still relatively unaffected. Hence it is not surprising that we find the typical failures shown in Fig. 2.

About five years ago, Carnegie-Illinois Steel Corporation (now United States Steel Company) built an experimental car to demonstrate several ideas for meeting the corrosion problem. There was no thought that the car represented the ultimate in construction, rather the hope was entertained that it would stimulate wider thinking toward the development of further improvements.

Among the ideas was the side sill arrangement shown in Fig. 4-B. By way of comparison the standard construction is given in Fig. 4-A. Through redesigning, it became possible to eliminate the ledge, thereby removing one source of trouble. The new hopper cars of the Chesapeake & Ohio have the side sill detail shown in Fig. 4-C and again the ledge has been effectively eliminated. In both cars, a corrosion resisting, high-strength steel was used as an added margin of life expectancy.

Vibration is undoubtedly a contributing factor to the failures of side sheets along the edges of supporting members. There are many opportunities for investigation of problems arising from vibration in railroad rolling stock, but the subject is a very complicated one. Flat sheets, as in hopper car sides, are particularly susceptible to vibration—the effect of which is to bend the sheets most severely at the supporting edges. Every object has a natural frequency of vibration and when the exciting force is applied with the same frequency, there is a pronounced and often violent increase in the amplitude of vibration. This phenomenon is known as "resonance."

The consequences of vibration are accelerated corrosion and loss of strength from reduced sections of the sheets at the supports, where stresses are at a maximum. Wherever resonance is encountered, it is imperative to change the natural frequency, but in any case where vibration is troublesome the problem can be met in

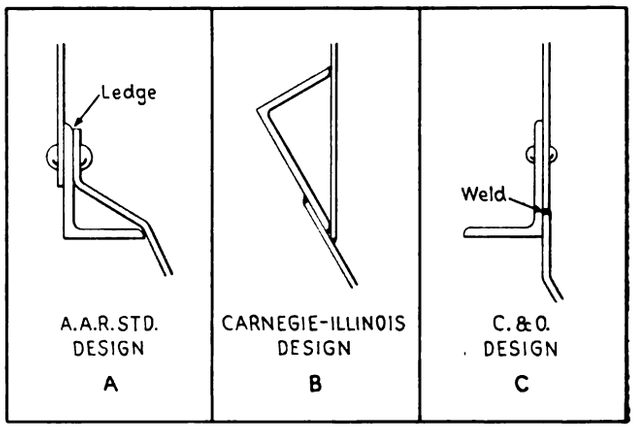


Fig. 4—Side-sill sections

several ways. The size of the flat panels may be changed by decreasing the spacing between side stakes or by adding stiffeners or corrugations to break up the panels into smaller flat areas. Increasing the thickness of the sheet will increase the frequency but decrease the amplitude of vibration and decrease the induced bending stress. No set rules can be laid down—the solution is perforce a matter of trial.

Car shakeouts for unloading hopper cars have been on the market since 1946 and their operation depends upon the vibratory action set up by revolving eccentric weights. The action is so severe as to shake the whole car body and to set the side sheets into pronounced vibration. The rust scale is not only loosened at the supported edges but over the entire area as well. As will be shown presently, the most damaging effect of the vibration arises from the bending moments at the supports. The stresses resulting from these moments are increased by the presence of a reduced thickness of material or of corrosion pits which act as stress raisers.

In 1934 the Pressed Steel Car Company brought out a 50-ton hopper car of high-strength steel, weighing only

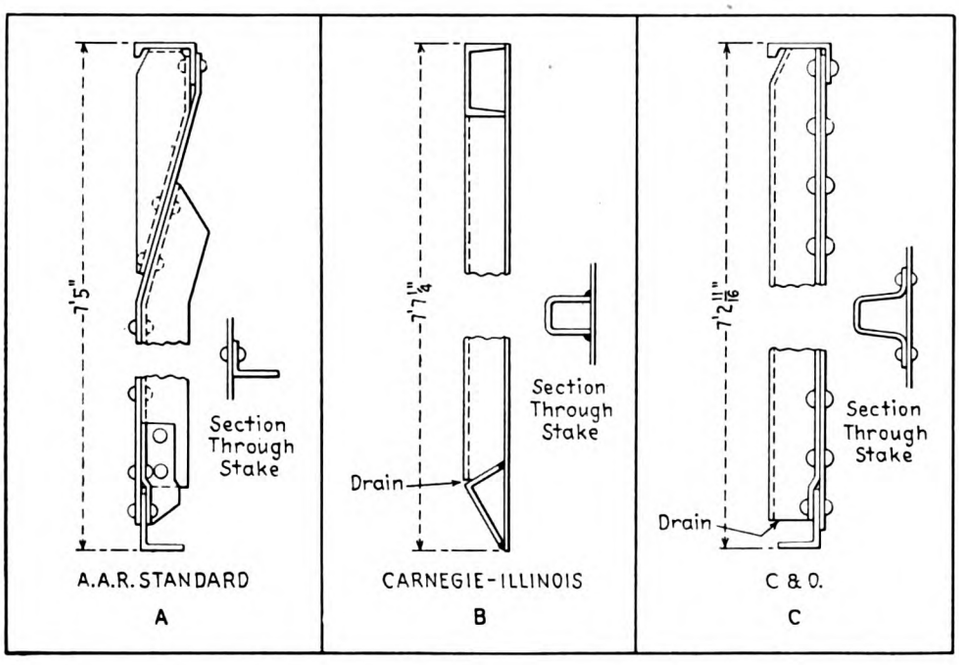


Fig. 5—Side construction

30,000 lb. The side sheets were only 3/32 inches thick as compared to standard construction with 3/16 inches sheets of copper steel. After 100 of these cars had been in service about 11 or 12 years, the typical failures along the side sill angles began to appear just above the usual ledge. This length of time to failure did not differ greatly from that in sides of 3/16 inch copper steel. The added corrosion resistance of the high-strength steel could hardly account for all of the performance of the 3/32 inch sheet. Again, we look for a possible reason and find it in the design. Each of the side panels was dished outward in a buckled form. Vibration could not flex the buckled sheets in the manner common to flat sheets, and there seems little doubt that this particular feature of the design accounts in part for the relatively superior performance of the thin sheets.

The relative merits of inside and outside stakes are worth careful consideration. From the standpoint of corrosion, inside stakes have very little in their favor. It should always be remembered that steel surfaces on the inside of a hopper car are not painted and are fully exposed to corrosive action. Inside stakes also impede the smooth flow of lading and the construction affords numerous opportunities for local corrosion.

Fig. 5 illustrates the side construction of the A.A.R. standard hopper cars with inside stakes and two other designs with outside stakes. It is evident that the construction for inside stakes is more elaborate,—requiring the forming of the side sheets, the trimming and forming of stakes and outside extensions. By contrast, the other types of construction require no forming of the sheets and the stakes are of simple form. Furthermore, the stakes can be kept painted since they are not exposed to the lading.

The smooth interiors of the Carnegie-Illinois and C. & O. designs reduce the chances for local corrosion. Contrast these types of construction with the standard design in the photograph of Fig. 6 showing an inside stake and the accumulation of dirt on ledges and in crevices.

One of the arguments against the use of outside stakes is the loss of volume which has to be made up by increasing the length of cars. A moderate increase in height—

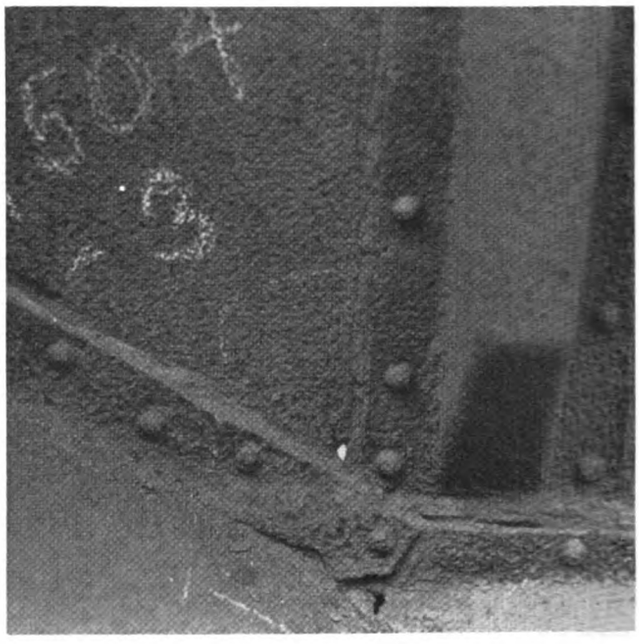


Fig. 6—Accumulation of dirt on ledges at inside stake

not to exceed four inches—can be made, thus requiring less additional length. The chart of Fig. 7 gives the increases in height and length for 50-ton and 70-ton A.A.R. standard hopper cars to maintain the same volume with outside stakes as in the original designs having inside stakes. While the standard height is 10 feet 8 inches, there are many cars with a height of 11 feet 0 inches. The center of gravity of a fully-loaded A.A.R. 50-ton car is 80⅜ inches above top of rail while the Carnegie-Illinois car with 11 feet 0 inches height had a center of gravity height of 82¾ inches.

An important point in design of stakes is to provide for drainage of any moisture from the inside. Water will seep between the faying surfaces of the stakes and sheets and collect inside unless drainage can take place. The

stake in Fig. 6 apparently has no such provision. The outside stakes in Fig. 5 have outlets as indicated. In the case of the Carnegie-Illinois car the opening was inadvertantly closed by welding. When the welds were chipped out, some of the stakes were found to have as much as two quarts of water entrapped. It had seeped in between intermittent welds connecting the stakes to the sheet.

The life of floor sheets in hopper cars is not entirely determined by corrosion. Present-day methods of unloading with clam shell buckets, building fires under cars to thaw frozen lading, and the impact of lading falling from considerable heights subject the floor to very severe abuse of a destructive character. This mechanical damage has the effect of loosening rust scale, distorting the sheets, opening joints and thereby clearing the way for fresh corrosion attack. Design must meet these conditions by providing adequate stiffness in the floor supports.

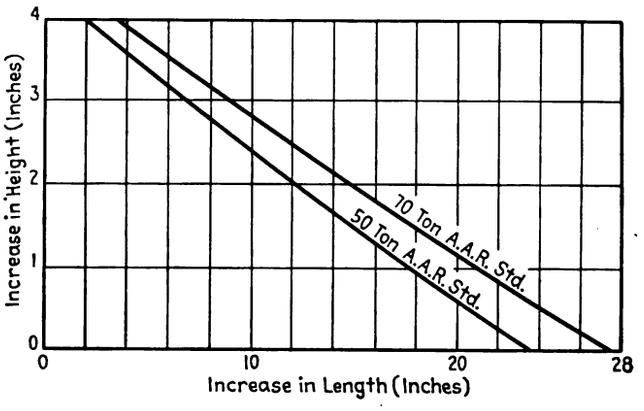


Fig. 7—Equal volumes of hopper cars

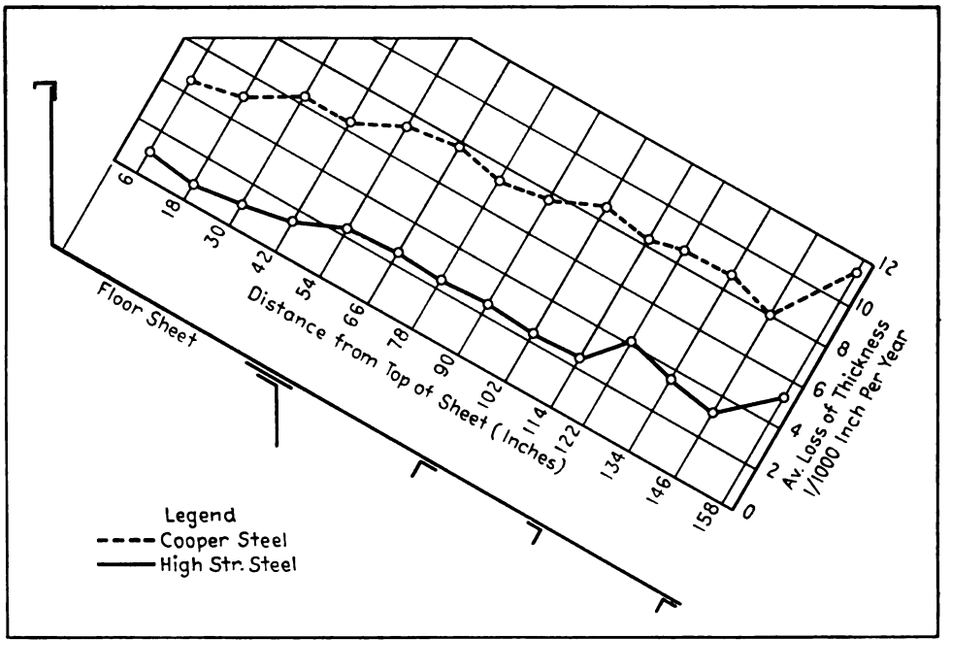


Fig. 8 — Corrosion loss in floor sheets

As in the previous discussion of side sheets, it is well to examine the nature and location of failures that commonly occur in the floors. Fig. 8 shows the losses in thickness as found in the investigation of service life of various grades of steel. One readily recognizes the increasing rate of loss from the upper end of the floor to the door opening. We have here a case where erosion plays a part. The loss is related to the depth and weight of lading and the quantity that slides over the surface of the steel. It is becoming more common practice to recognize this condition by increasing the thicknesses of the floor from the ends to the hopper chutes.

One of the striking facts about floor failures is their proximity to the supporting members. There must be a reason for this, and again it is a case where bending or flexure enters into the situation. The condition is aggravated when the flexure is accompanied by excessive deflection of the sheets, as may occur when the floor stiffeners are not adequate. This is shown in the photograph on page 43.

Fig. 9 shows a failure in a floor sheet just above an inside stake at the body bolster. The collection of dirt behind this stake, even with a small deflecting plate welded in the corner, undoubtedly contributed to the acceleration of corrosion. Then too, the flexure added its contribution with the inevitable consequences. In this particular case, the condition was further complicated by the failure of the upper floor stiffeners to function effectively—resulting in excessive deflections.

The failure of these floor stiffeners is an interesting case. They were zees extending from the end of the car to the bolster. Being of an unsymmetrical section, they eventually twisted in a manner to lose much of their strength and permitted the upper floor to sag several inches. As a part of the major repairs to these cars, the zee stiffeners have been replaced with present channels, back to back, which form symmetrical members that provide better support.

It has been noted that failures of floor sheets are more numerous at the edges of supporting members. A contributing reason for this tendency may be found from a consideration of the two cases of bending illustrated in Fig. 10-A. The plates are assumed to be fixed at the supports in both examples. The upper sketch shows a plate being bent downward over a rigid support and it should be noted that the bending effect is concentrated

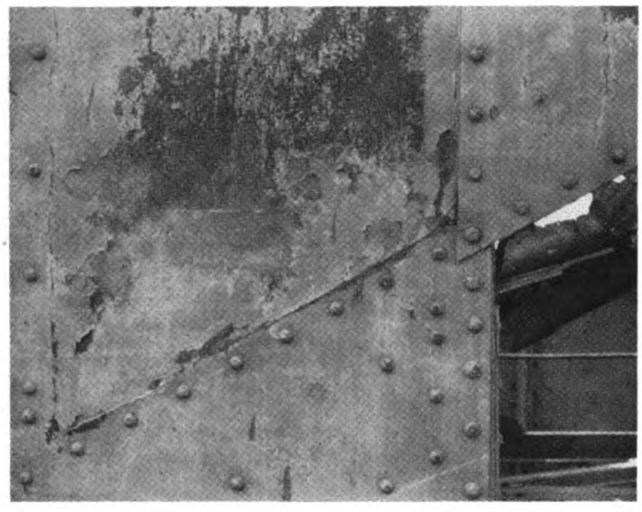


Fig. 9—Failure of floor at bolster stake

the floor is supported on a thick and comparatively rigid beam flange and will be bent more sharply at the edges.

The construction shown in Sketch D is similiar to that shown in the car on page 43 where it will be seen that the failure was at the lower edge of the bolster flange plate. While the floor sheet at edge *B* has an intermediate support, the cantilever portion of the flange plate may have been short enough to have had considerable rigidity.

An improved detail is illustrated in Sketch E, (Fig. 10) in which all the lapping of the floor sheets is over the bolster flange, concentrating the rigidity there and giving intermediate support to the floor at edges *A* and *B*.

Another attempt to provide flexibility at the bolster is shown in Sketch F and is the construction used in the Carnegie-Illinois experimental hopper car. Bending of the flange of the beam bolster was avoided in favor of press-brake forming of what might be called a bolster extension. The vertical leg and flanges of this extension were intended to relieve the stress concentration.

In all of these sketches, the reader should keep in mind the erosion to which floors are subjected and relate it to

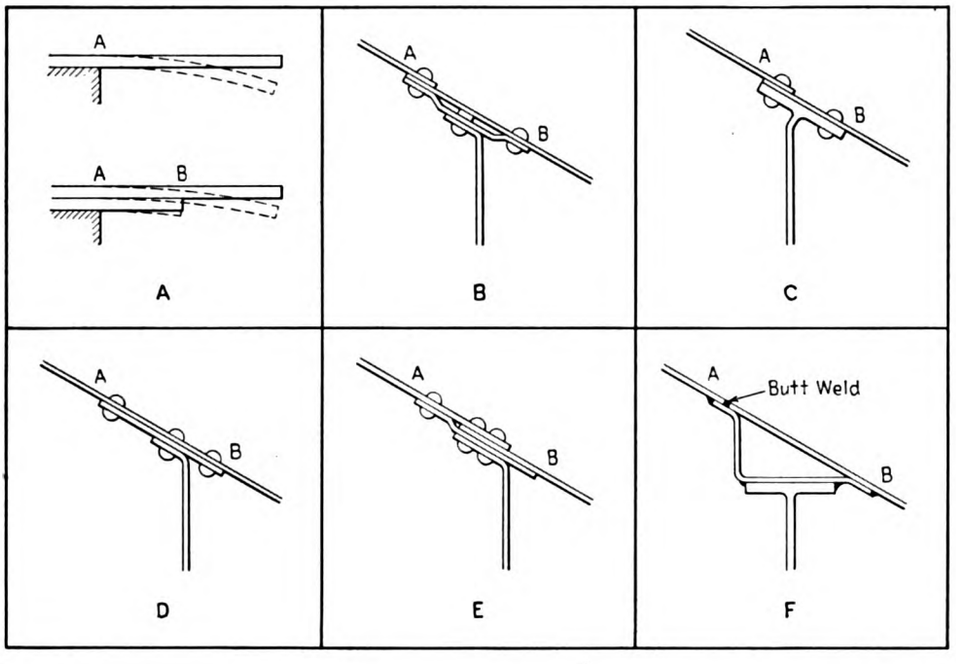


Fig. 10—Floor to bolster connections

at the supporting edge, *A*. In the lower sketch an intermediate plate is introduced which participates in the bending at the support and acts as a cushion to the top plate, as well as serving to distribute the bending effect over a greater distance. This construction is often followed where it is desired to reduce the stress concentration at points of rigid support.

Some examples of the construction around the top flanges of body bolsters may be examined in the light of the foregoing discussion. These are depicted in Figs. 10-B to 10-F. The floor sheet in Sketch B has an intermediate support at edge *B* and also at edge *A*, but at the latter location the lower floor sheet is in the joint and adds extra stiffness or rigidity. Hence the condition at A should be less satisfactory from the standpoint of concentration of flexure in the upper floor sheet at the edge of the supporting member. Sketch C shows a rather common type of beam bolster with the top flange bent to the 30-deg. slope of the floor. At both edges *A* and *B* the bending of the sheets. The evidence is ample to connect the combination of these two factors to the concentration of premature corrosion failures at the edges of rigid supports.

The lower edge of the hopper sheet over the door angle is often a point of early failure. A combination of the heaviest load and the greatest amount of erosion occurs here. Fig. 11-A shows the details of the construction to be found in most cars. Failure usually occurs at edge *A* where the leg of the door angle normal to the floor sheet furnishes a stiff support for the sheet. An endeavor to meet this condition was made in the Carnegie-Illinois experimental car and is depicted in Fig. 11-B. A reinforcing plate, 12 inches wide, was added to distribute the flexure away from the edge *A*. Of course the erosive action during unloading will inevitably reduce the thickness of the floor sheet and when failure occurs the reinforcing plate is in position to support the lading. In effect, the ultimate patching operation was performed in

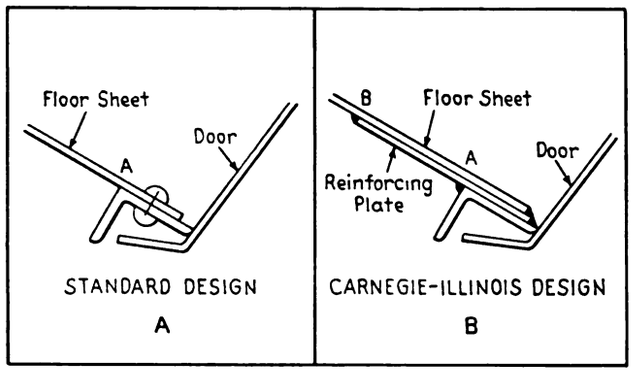


Fig. 11—Detail at door frame

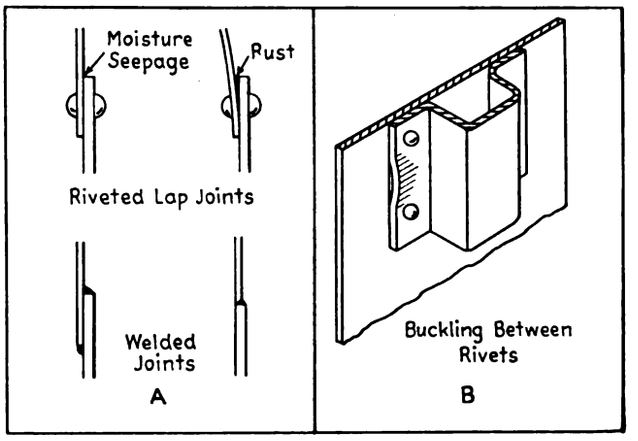


Fig. 11—Detail at door frame

advance and the beneficial support from the plate was obtained from the outset.

The lower flange of the door itself serves to catch coal leachings when they run over the lip and along the bottom surface before dropping to the ground. Thus the flange can be attacked on both surfaces—a condition that is not good from the standpoint of corrosion.

The design of joints should not be overlooked as a factor having a bearing on corrosion. The riveted lap joint of Fig. 12-A has an inherent possibility of moisture seepage between the faying surfaces. Rusting is likely to follow and often the corrosion product, since it occupies a much greater volume than the original steel, will force the surfaces apart. This is particularly true of thin material and actually happened in some side stakes (Fig. 12-B). The flanges were buckled between rivets—which be it said, were spaced further apart than the thickness of material warranted. Corrosion did excessive damage, resulting in the replacement of the stakes at the time of the first major repair.

Specifications generally contain limitations on the spacing of rivets in compression members to assure the strength against buckling and to obtain a tight joint.

It is well to remember that the expansion of rivets during driving sets up compressive stresses in the surrounding materials which can cause wrinkling or buckling between rivets. In an early application of high-strength steel side sheets to box cars a lesser thickness than the usual 0.10 in. in copper steel was used. Smaller rivets on closer spacing were thought desirable for a watertight joint. A trial indicated, however, that the usual size of rivet and spacing were better.

Welding Offers Design Opportunities

Welding has presented engineers with a broad field in which to devise and develop new designs and to make a fresh and often novel approach to old procedures. In its relation to corrosion, welding has opened new possibilities for sealing joints against moisture, as is readily apparent from the sketch in Fig. 12-A. It has offered opportunities for eliminating lap joints in favor of butt joints. A study of the sketches in Fig. 4 will quite clearly reveal the part played by welding in achieving conditions effective in reducing corrosion damage. Fig. 10-F illustrates the use of a butt weld to eliminate the usual lap joint in the floor. A similar joint is used in the C. & O. cars.

The discussion, so far, has centered around the hopper car because the writer believes that most of the corrosion problems are typified in this car. Corrosion in all cases is basically the same process and only the environment varies. The presence of moisture, certain chemicals or mechanical action will produce similar effects in any type of car.

Box and refrigerator cars have special conditions arising from condensation of moisture, which collects in low spots and pockets. Obviously, effort should be made to eliminate such places, wherever possible. A good example of changes for the better is evident in the progressive development of details in the region of the side sill. Figs. 13-A and B show two stages in evolution.

Sketch A illustrates the construction that was quite common practice 20-25 years ago. Condensed moisture, running down the inside surface of the side sheet could find its way rather easily between the grain strip and floor plank and the steel sheet, where it would be retained for a considerable period. This is not favorable condition with respect to corrosion. A later A.A.R. design, which is still standard, shown in Sketch B, used a 6 in. x 3-1/2 in. x 5/16 in. angle with the long leg vertical, thus removing the thin steel side sheet from the region where moisture collects. It is true that there is a small ledge formed by the top toe of the angle, but this point is exposed to the air so that the moisture that does collect can more readily evaporate than in the case where it is trapped between surfaces. However, this small ledge is a good place to apply some protective compound to reduce the possibility of corrosion.

Fig. 13-C is illustrative of the construction proposed for a design in high-strength steel. In view of the above discussion it would seem as though the conditions with respect to corrosion are more like those in Sketch A and therefore less favorable for retarding corrosion.

In a lot of 97 box cars the lower corners of the end side sheets began to corrode through after about ten years and have had to be patched. The repair has been made on many of the cars and as any of the remainder return to the home line the same condition is found to exist. Otherwise, the side sheets are in good condition. A flanged gusset between the side sills and the end posts of these cars was found to be contributing cause. The gusset and side sheet were in close proximity and the space between them served to collect dirt and moisture.

Special Causes of Corrosion

Refrigerator cars are a special case since salt brine is almost always present. Drippings are a serious problem

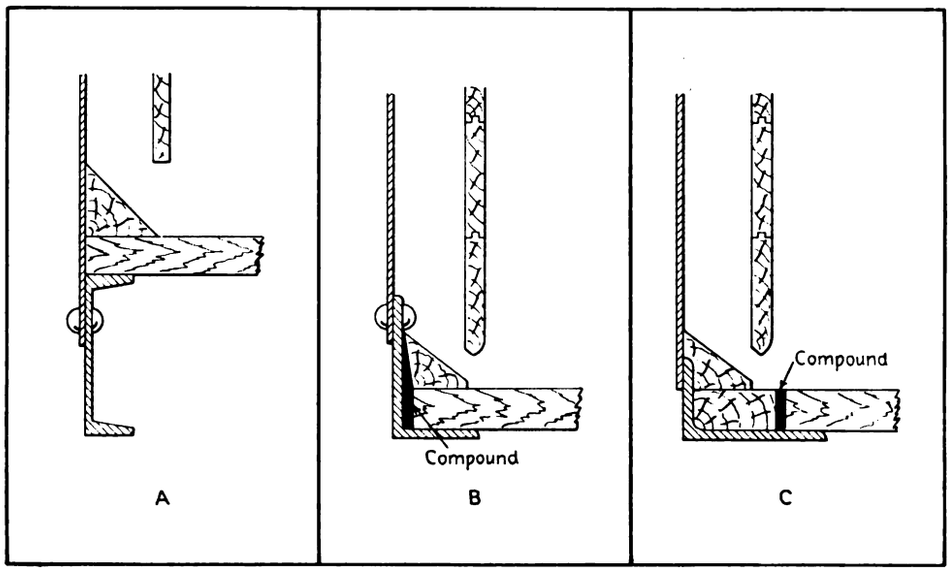


Fig. 13 — Construction at side sill of box cars

not alone to the underframe of the cars but to the track and bridge structures. The A.A.R. is giving much study to this whole matter.

Galvanizing of all steel in contact with ice and salt brine is the common method for protection against corrosion. It is essential to prevent access of brine to those parts of the steel structure which are not protected by galvanizing. The writer knows of a case where brine from overhead bunkers splashed over the edges and ran down the side sheets, causing serious damage to the sheets and side posts.

Gondolas and flat cars with wood floors are subject to corrosion where the wood rests on the steel and retains moisture in the joint. During the repairs to a lot of gondolas it was noted that the center sill covers were badly corroded along the center line. This rather singular occurrence led the writer to investigate the buckling resistance of this cover plate in compression. Because the ratio of its unsupported width to thickness was large it had a small margin against buckling. It seemed quite probable that buckling took place along the central portion of the plate, loosening the rust film, exposing the underlying steel to fresh attach and eventually leading to the failure that took place. Here was a case where design could help to correct a difficulty arising from corrosion.

Passenger and dining cars have contributed a generous share of corrosion problems. Great quantities of moisture must be handled in these cars and ventilation disposes of most of it. However, it is difficult to deal with the condensation on cold sheets and the penetration of moisture into cracks and crevices. No detail of construction is too insignificant to warrant a study of its corrosion potentialities.

The possibility of corrosive leachings from insulation should not be overlooked. In one instance, a hair insulation had been fireproofed with magnesium chloride which caused very serious corrosion of stainless steel and would have produced an even more severe attack on plain steel.

Car washing compounds containing acids, such as oxalic acid, can be troublesome, particularly if the joints are not tight. Vibration and working of a structure increase the difficulty of maintaining tight joints, but it is the function of design to endeavor to prevent the access of moisture to the interior parts of a structure. A case in point is a corrosion attack that occured in the sheets adjacent to the curved corners of some windows. The flexibility of the sheet at these points appeared to be the most likely cause and it is possible that a small stiffening element across the corners would have prevented the trouble.

The widespread use of various metals in passenger cars places the designing engineer under the necessity of giving attention to the possible contact of two metals that may cause galvanic corrosion if moisture is present. For example, contact between stainless steel and plain steel may cause an accelerated corrosion of the plain steel.

The construction details of passenger cars are so varied that no attempt has been made to deal with them specifically. Either the elimination of pockets where moisture can be retained or added protection are two general principles to be followed in reducing corrosion.

Some of the high-strength, low-alloy steels on the market today are much more resistant to corrosion than structural carbon steel. With such steels available, the remedies for exessive corrosion have not been exhausted by the designer who has given consideration only to the methods so far discussed.

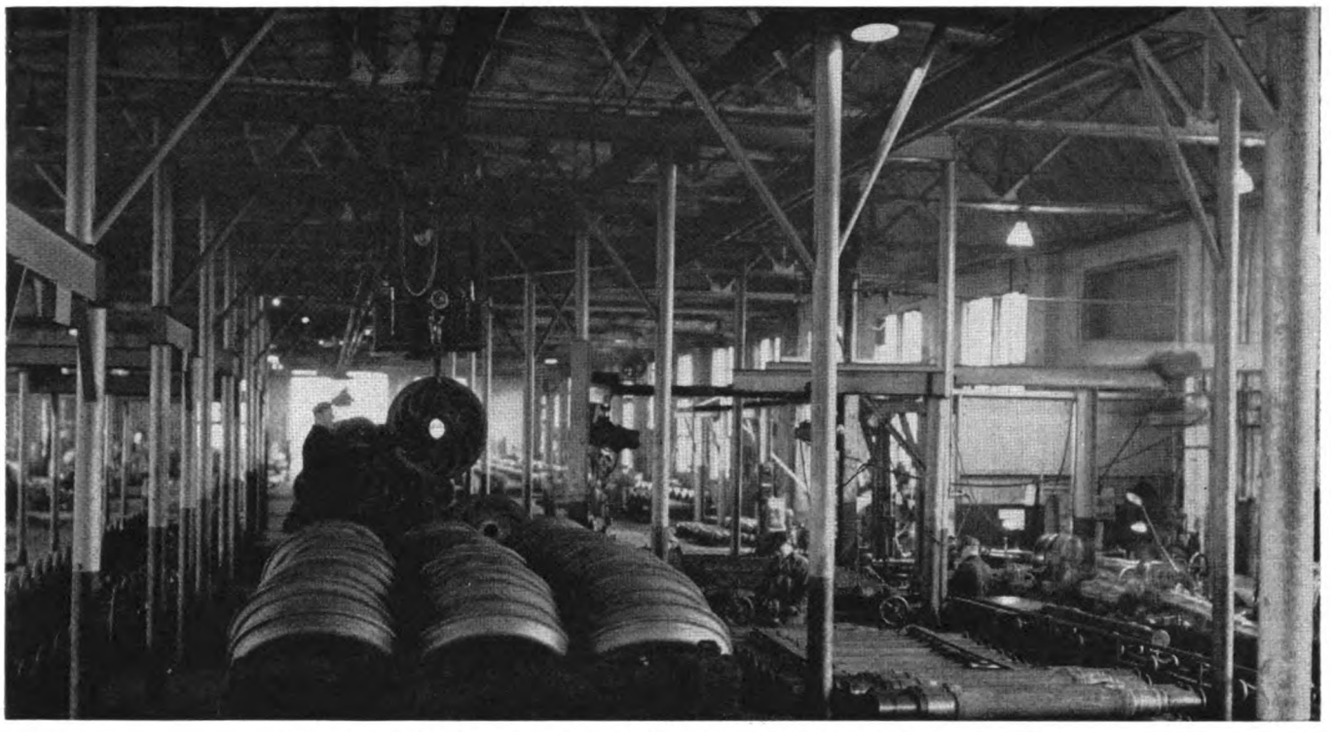
Reference again to Fig. 1 will afford a comparison over a period of 11 years among these steels when exposed in an industrial atmosphere. *L* is a structural steel with low residual copper content, *K* is a structural copper steel and the remainder are high-strength steels. It should be noted that not all high-srength steels possess outstanding corrosion resistance, although most of them are as good as, if not superior to, copper steel.

At the end of the test period the relative rates of resistance to corrosion, with steel *L* as the base, were *L*: *K*: *A* as 1.0: 2.5: 6.3. It is commonly stated that the atmospheric corrosion resistance ratios of these three steels are as follows: Carbon steel=1.0; copper steel= 2.0; high-strength steel (Most corrosion resistant composition) =4-6.

The actual service experience will naturally vary consederably from the above ratios, depending upon the environment and conditions of operation. The charts of Fig. 3-A and Fig. 8 afford a direct comparison in hopper car service between copper steel and a corrosion resistant high-strength steel. These curves are an integration of all the factors affecting the life of side and floor sheets.

Long experience with copper steel indicates that its life

(*Continued on page 60*)



How loose wheels are received at the shop and unloaded by monocrane

Milwaukee Modernizes Its Wheel Shop

Excellent results secured with modern monorail system, revised shop layout and only a few new machine tools

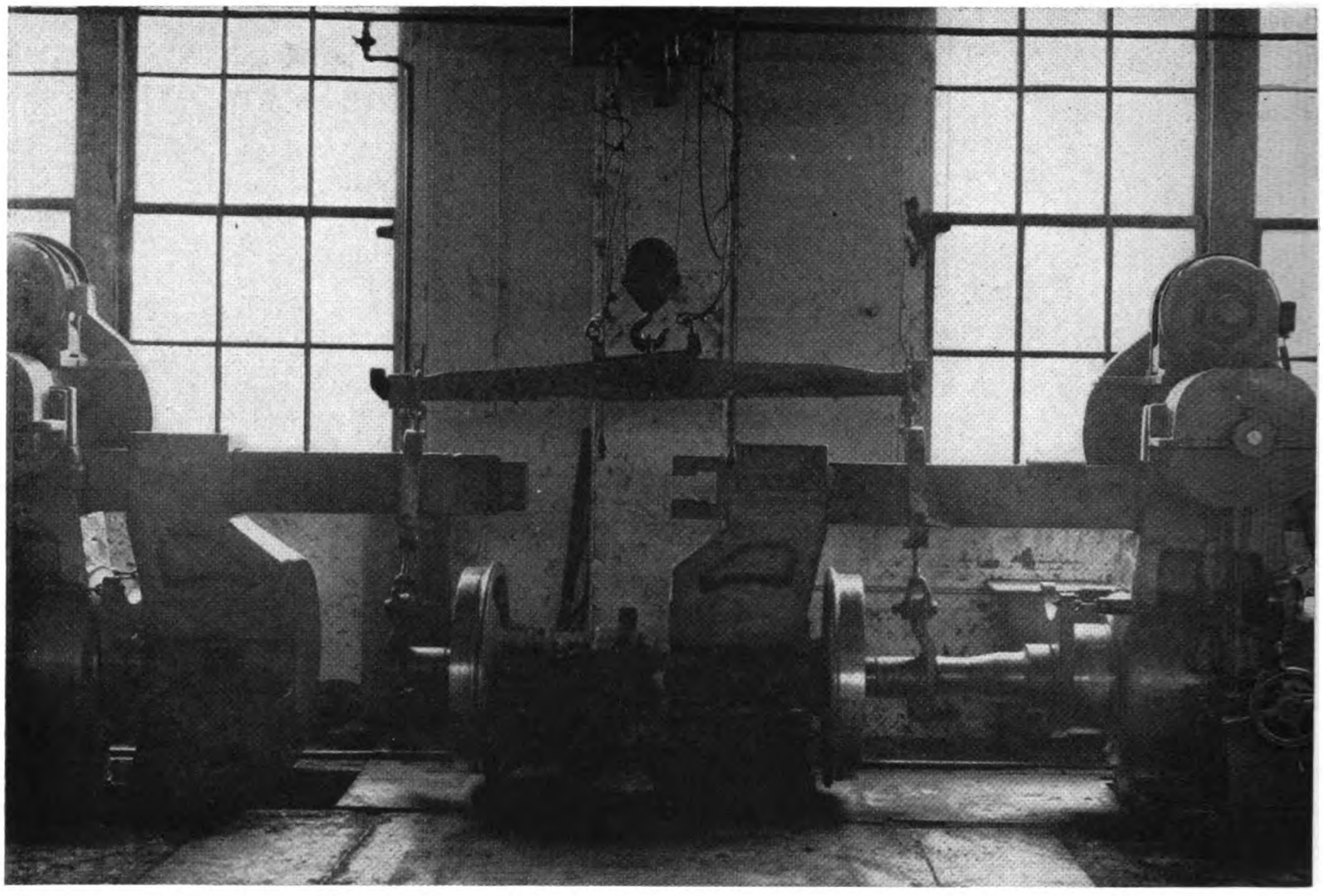
THE new car-wheel shop of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has now been in service more than two years and has demonstrated economy in the handling of parts, flexibility in operation and the capacity to turn out quality work in quantities adequate for most system requirements. In fact, the only other wheel shop on the railroad is that at Tacoma, Wash., where wheel and axle work for lines west is performed.

In operating the new wheel shop, primary attention is paid to the quality of workmanship which meets all A. A. R. requirements. A full assortment of master wheel gages is available for periodic checking of all shop gages, and all machines are inspected at specified regular intervals. Axle lathes and wheel boring machines are equipped with standard micrometers and dial micrometers. All wheel-mount recording gages are checked weekly. The Magnaglo machine is checked once each shift with a test axle having a minute known defect to make sure that the machine is functioning properly. All axles passing through the shop are Magnaflux or Magnaglo tested. All second-hand wheels and axles received at the wheel shop are carefully inspected for defects before processing.

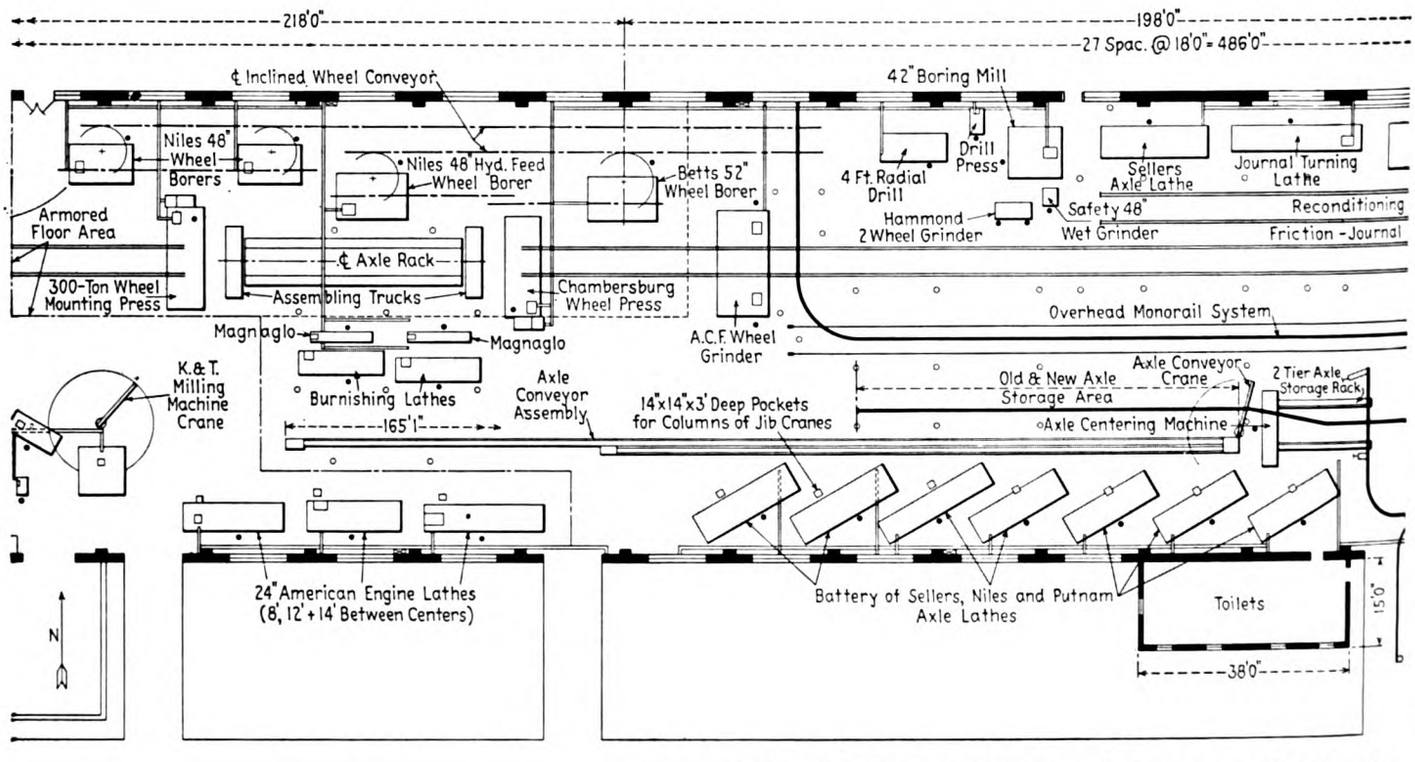
Shop Output

The output of the shop under present conditions, working a five-day week and about 1⅓ shifts in 24 hr., is such that three cars a day are shipped in and out, each car being designed for the double-deck loading of 48 pairs of mounted wheels. The Milwaukee has about 100 of these wheel cars on the system.

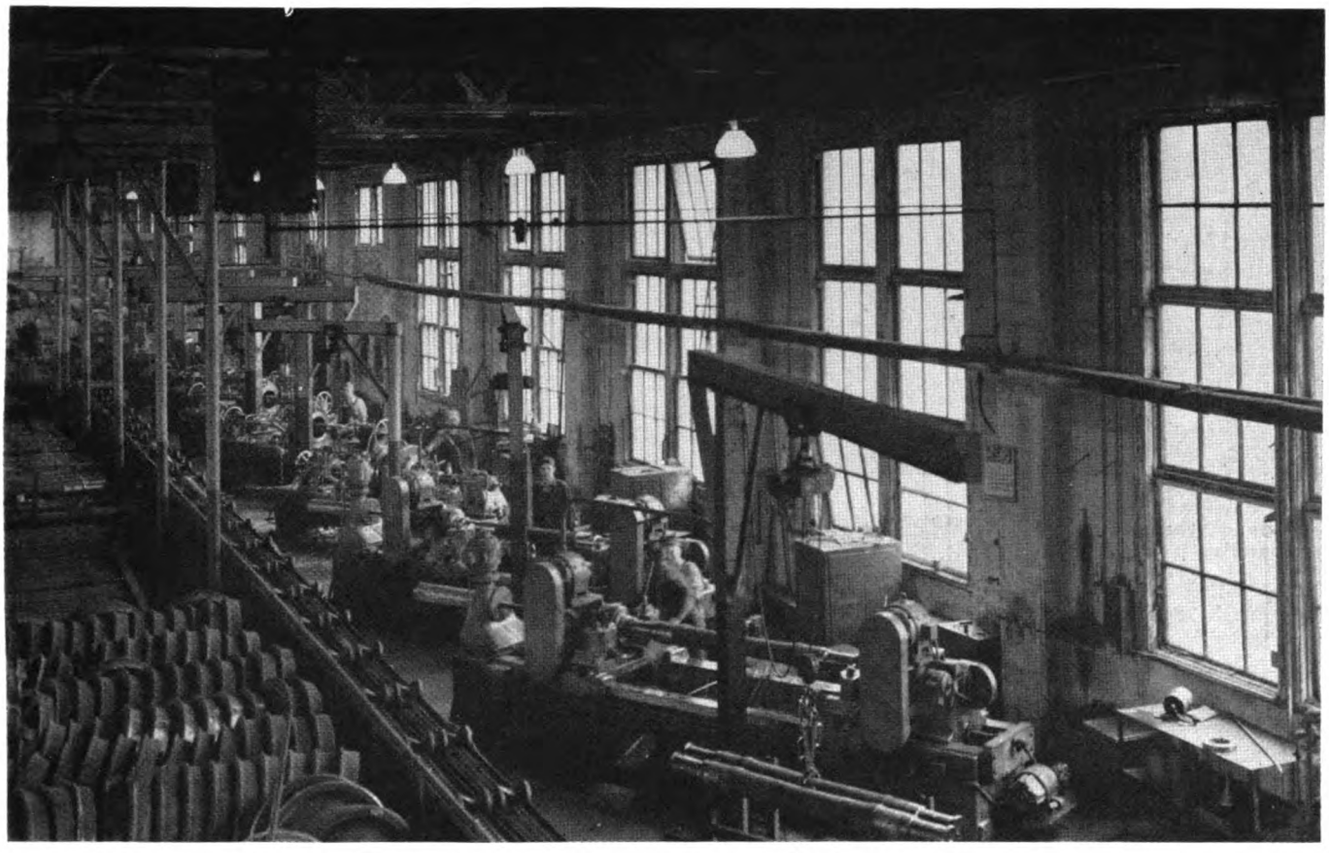
The center unloading and delivery track at the east end of the new shop will hold seven cars but is seldom used for over six, which is more than enough to permit



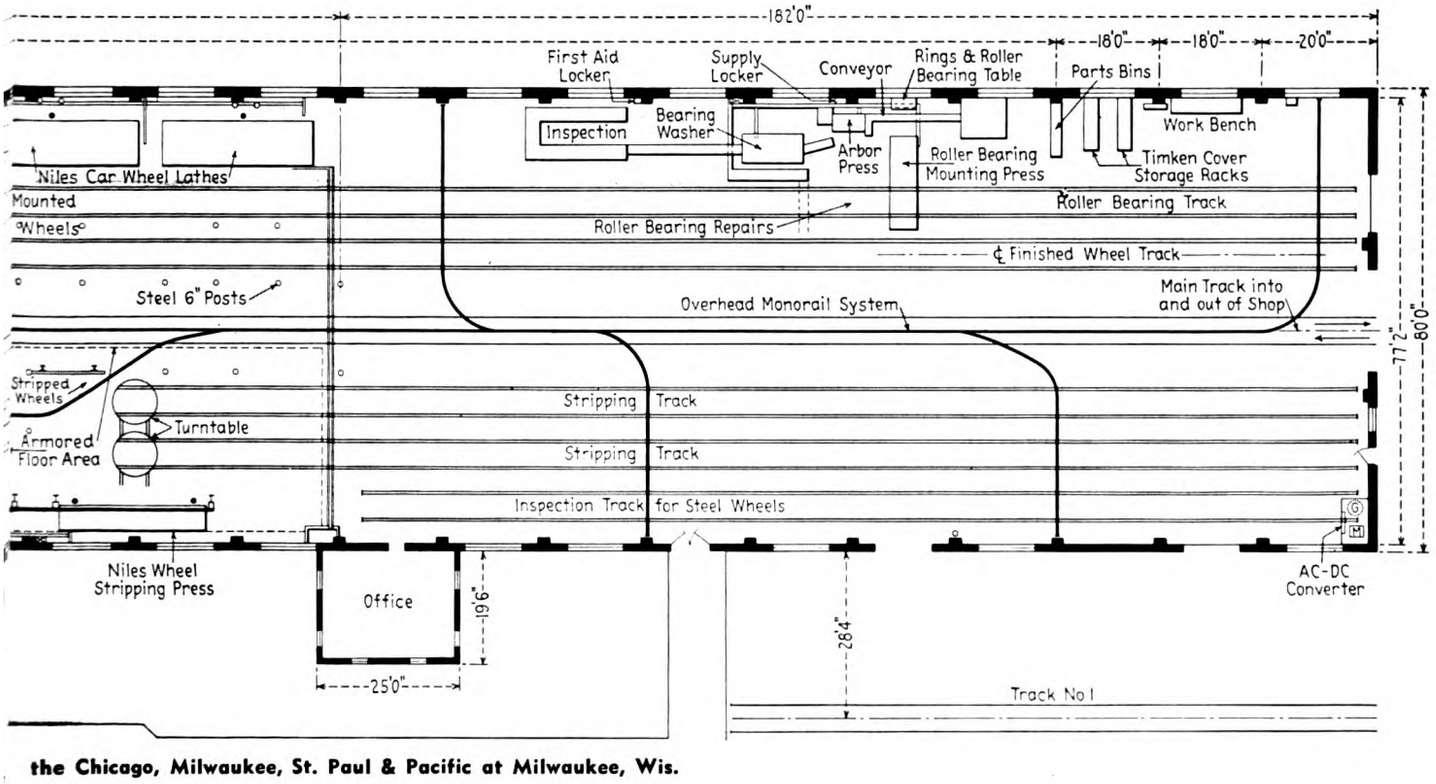
Double-rail turntable at the Niles stripping press which turns easily on roller bearings



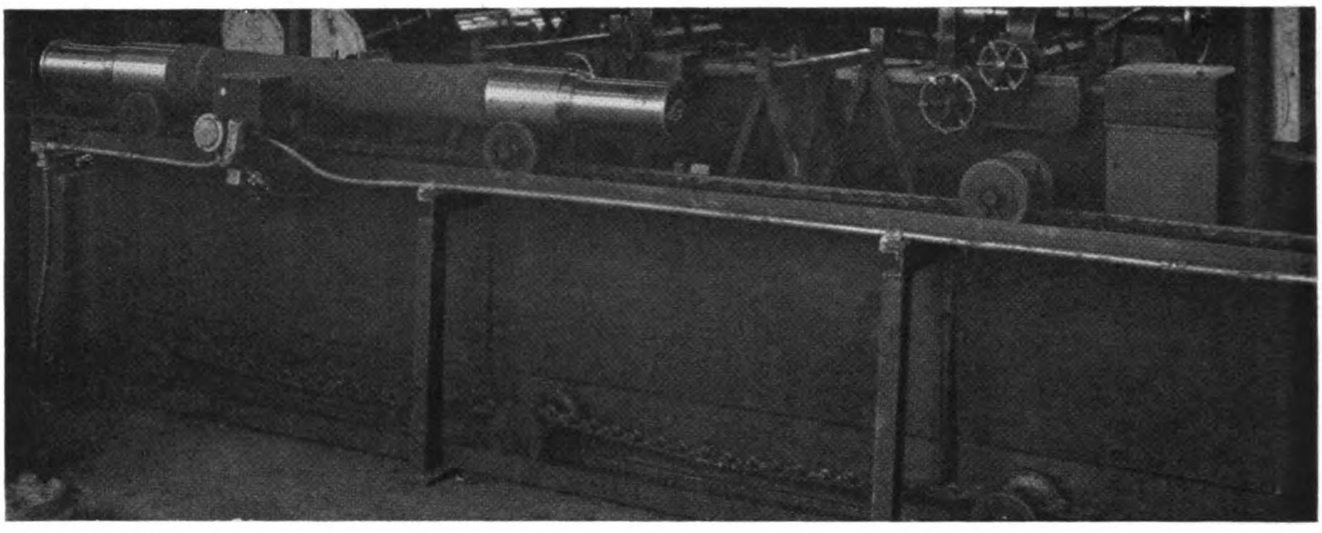
Layout of machinery and equipment in the new car wheel shop of



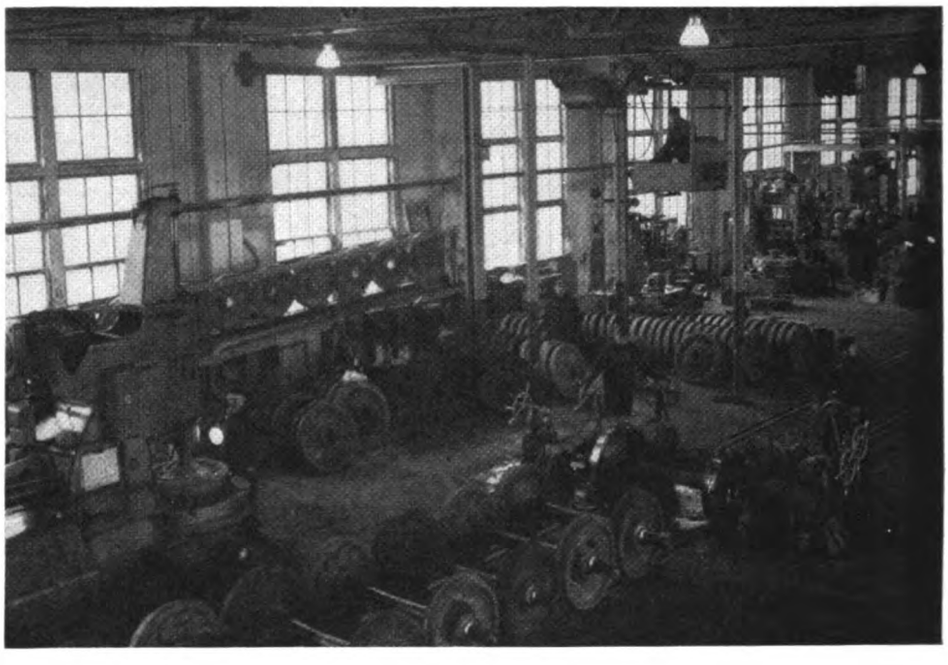
Battery of seven axle lathes served by axle-feed conveyor



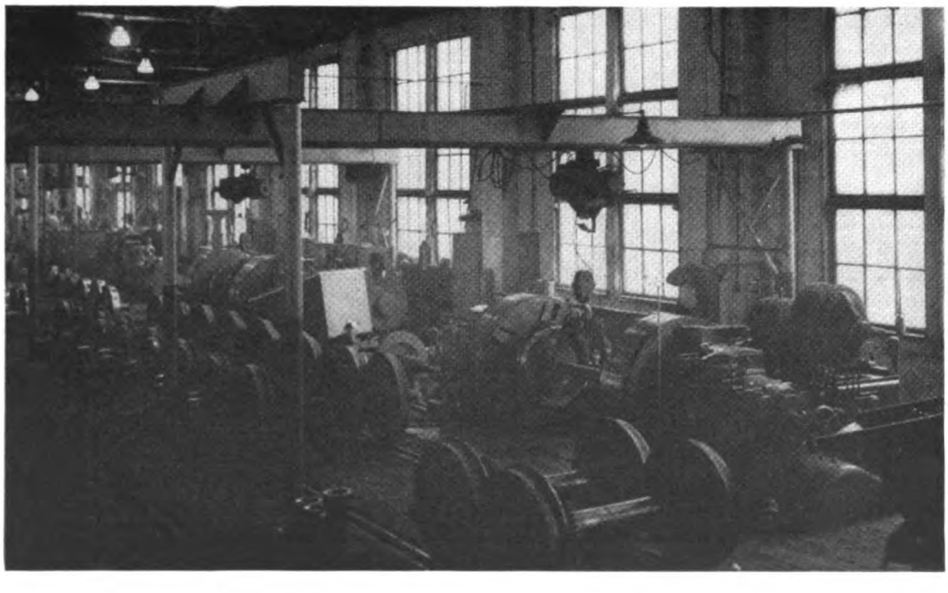
the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis.



↑ The axle-feed conveyor and one of the electric-eye controls



Wheels moving to A.C.F. grinder — Monocrane has just delivered wheel to wheel chute on shop wall →



← Facilities for handling mounted wheels at wheel lathes

handling the full production of wheels and axles in and out of the shop each day with a single switching movement. It is estimated that, with a full force and two or three shifts as required on some individual machines or operations, a shop production in excess of 300 pairs of mounted wheels a day can be turned out, including truing the journals on about 80 pairs of mounted second-hand wheels.

This is approximately double the production formerly secured with the same number of men. It is attained while meeting even more exacting requirements of A.A.R. than formerly; also in spite of the fact that only about 70 per cent of the wheels now handled are cast iron, as compared with 90 per cent formerly.The increased percentage of steel wheels handled requires substantially more time for machining.

Improved Material Flow

Most of the improvement in output at the new Milwaukee car-wheel shop is credited to rearrangement of machinery and equipment, installation of the monorail system, gravity wheel chutes and other devices to expedite the handling of wheels and axles, either mounted or unmounted, and thus save both time and labor.

The only new machines, purchased in 1948 and installed in the Milwaukee car wheel shop, included two Sellers axle lathes, a Niles 48-in. hydraulic-feed wheel borer and one Chambersburg 300-ton wheel mounting press. All other machinery was transferred from the former car wheel shop at Milwaukee and included a number of axle lathes and wheel borers, built prior to 1936 but kept up to the mark as regards accuracy through constant checking and adjustment by experienced operators and the shop machine maintenance crew.

The shop is also equipped with an A.C.F. car-wheel grinder purchased in 1942, and a roller-bearing washing machine purchased in 1941. These individual machines are of such importance to the shop output that their installation was a practical necessity, beyond the scope of a return on the investment.

Shop Layout

The layout and equipment of car wheel shop are clearly shown in the drawing. The building available for this work had too low headroom for an overhead crane so it was decided to feed the material to the lathes, mounting presses, burnishing machines, etc. by the use of an overhead monorail system and wheel and axle conveyors. The building itself is an old structure built originally in 1906 and portions of it rebuilt after a fire in 1931.

The overhead monorail system is an American Engineering Company product, supported from I-beams and steel pipes. There are three one-man operated, 2-ton Monocrane trolleys on the monorail system, one being an American Lowhead and the other two being Shepard-Niles. One of the latter is used as a spare. The two inclined wheel conveyors, or wheel chutes were constructed in the Milwaukee Shops and each feeds two wheel borers, as shown in the drawing.

Mounted friction-journal wheels for processing enter on wheel flat cars at the east door and are spotted under the overhead monorail, unloaded and placed on the stripping tracks. Here they are inspected and then rolled up to the turntables, turned and rolled into the Niles stripping press located as shown in the drawing.

Cast iron stripped wheels are rolled into the area marked "stripped wheels" where they are picked up by the overhead Monocrane and loaded on flat cars for delivery to the foundry. Scrap steel wheels are handled in the same manner for scrap sale. Steel wheels for remounting are handled by monocrane directly to the wheel conveyors for reboring.

Axles are handled on the small monorail system and placed on a two-tier gravity-roll axle-storage rack. Axles move into position at the centering machine where they are handled by a 1-ton hoist suspended on a rotary boom to the centering operation. Here they are wire-brush cleaned on the center portion between the wheel seats, according to A.A.R. recommended practice prior to Magnaglo axle inspection. The hoist also is used to load the axle-feed conveyor to the seven axle lathes. The gravity-roll axle rack is located so that the first axle lathe in line has access to any axle on the rack. This gives flexibility to the layout and allows for any emergency outside the general shop production run and will not interfere with the continuity of the shop operation.

The axle conveyors are designed with manually-operated electric lock stops at each lathe and are equipped with electric eyes at the end of the conveyors.

After the axles are turned in the axle lathes they are placed on the second conveyor and conveyed to the axle burnishing, axle Magnaglo and Magnaflux machines by monorail for inspection and to the axle rack directly in front of the wheel mounting presses, at which point wheels are applied to the axles and the assembly rolled into the wheel press for mounting. The axle conveyor is stopped when the axle has reached the end of the conveyor by an electric eye.

Mounted wheels are rolled through the mounting press directly to the wheel grinder where the treads are ground; from there to the loading tracks for loading on the wheel cars by the overhead monorail.

Carloads of friction journal wheels for tread turning are handled by means of the overhead monorail system to the two wheel lathes for turning. After turning the wheels are continued on the storage track ahead of the wheel lathes to the journal lathes for journal truing. From the journal-turning lathe they are magnafluxed on the shipping track and then reloaded.

Roller-bearing wheels entering the shop for processing are unloaded from the cars by means of the monorail system to the roller bearing mounting and stripping press track where the roller bearings and housings are stripped from the axle by means of a rebuilt wheel mounting press, as illustrated. At this point the bearings and housing assemblies are disassembled by means of an arbor press and propelled by gravity conveyor through the washer to the inspection center.

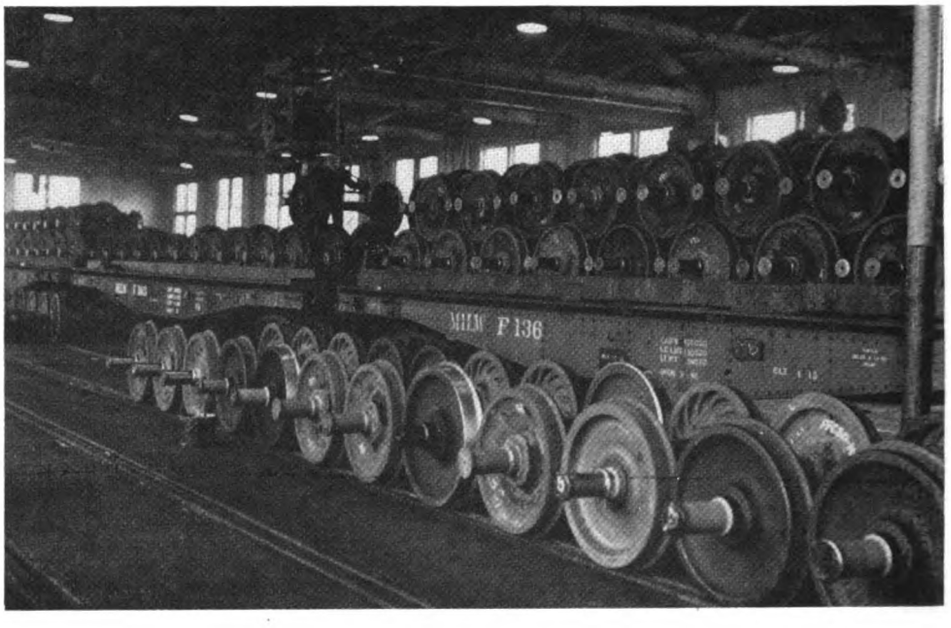
The wheels for turning continue on the roller-bearing stripping track to the wheel lathes where they are picked up by the overhead 4-ton electric hoist and placed in the wheel lathe for turning. Wheels suitable for passenger service are placed on the adjacent track to be conveyed back to the roller-bearing mounting press where the bearings and housings after inspection and reassembly are pressed back on to the axle.

Wheels unsuitable for passenger service but suitable for freight are transferred at this point by means of the monorail back to the stripping track and there stripped for reapplication to freight axles. Wheels found not suitable for passenger service are turned while on the roller-bearing axle to facilitate later reboring of the wheels for application to freight service.

The roller-bearing axle is stock piled immediately adjacent to the stripping press until a sufficient number



Details of wheel chute delivery to one of the boring mills



How mounted wheels are loaded on special flat cars for movement out of the shop. Each double-deck load includes 48 pairs

have been accumulated to warrant a run of wheels through the boring mills. Roller-bearing axles are processed in the same manner as the friction axles as far as handling is concerned except they are not put through the burnishing machine.

Roller-bearing wheels after mounting are processed through the grinder, the same as plain bearing wheels, and then transferred to the roller-bearing track by means of the overhead monorail where the roller bearings are reapplied the same as before.

All mounted wheels for shipment are loaded by means of overhead monorail on special wheel flats, all under the roof of the wheel shop.

Loose wheels coming into the shop are loaded on flat cars provided for that purpose, or in gondola cars coming from the various manufacturers. Both cast and steel wheels are unloaded from the car by means of overhead monorail used in connection with self-tripping tongs, and loaded into a gravity feed wheel conveyor to the various boring mills. Wheels are unloaded from the wheel conveyor to the boring mill by means of a gate that is tripped allowing the wheel to fall from the wheel conveyor to the post where it is lifted into the wheel borer by the usual wheel borer hoist. Wheels are rolled from the boring mills to the mounting press.

Outside facilities at this car wheel shop consist of track storage facilities capable of holding 2,000 pair of mounted wheels, plus adequate space for storage of loose wheels and axles.

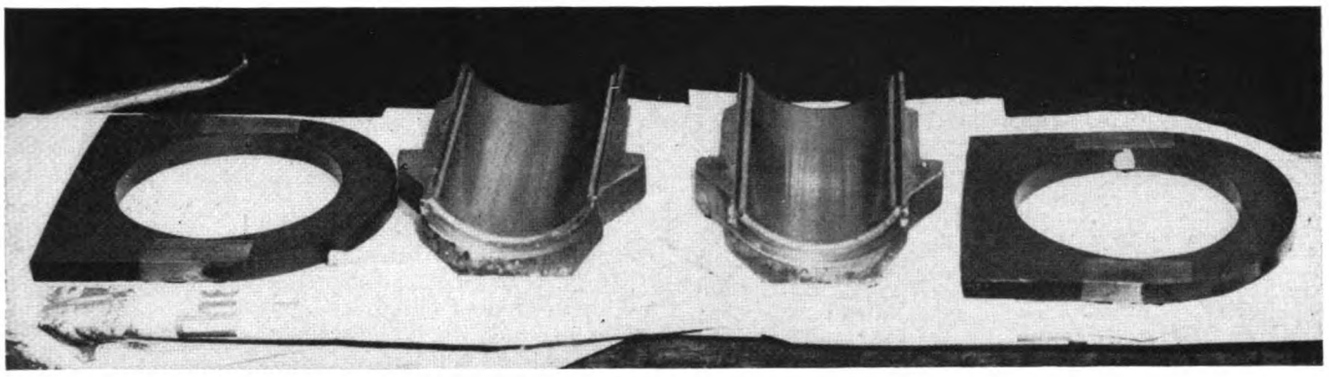


Fig. 1—Conditions of the bearings and axle stops at locations 11 and 12 in August, 1950, after 175,984 miles of revenue service

I. C. Tests Device To Reduce Hot Boxes

Results indicate that device to limit horizontal motion of axle can reduce hot boxes and other bearing damage

A DEVICE designed to prevent hot boxes and other damage to journal brasses from one major cause has been on test on the Illinois Central for the past two years. The device is known as the Axle Stop, and is a product of Axle-Stop, Incorporated, Chicago.

The purpose of the Axle Stop is to reduce the horizontal motion of the axle from impact or brake action, the latter particularly on cars with single-shoe brakes. In so doing the stop limits the cocking and lifting of the brass off the journal, and thereby lessens the possibilities of a hot box; the strands of waste do not have the opportunity to wedge between the journal and the brass.

The Axle Stop accomplishes this objective by reducing the clearance between the opening in the back of the journal box and the dust guard seat of the wheel. The stop is shaped like the conventional wooden dust guard, but is made of oil-resistant Neoprene rubber with steel inserts on opposite sides of the journal. It fits snugly in the dust guard well, and with a 1/8-in. clearance around the dust guard seat. The horizontal movement of the axle is thus restricted to the 1/8 in. before the dust guard seat of the wheel comes in contact with the steel insert.

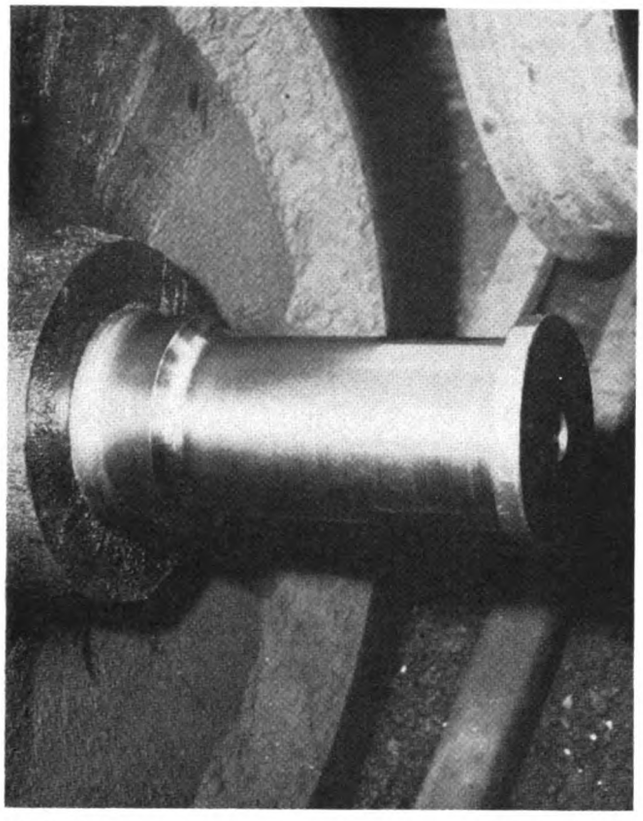
The test was conducted by equipping one of two cars in comparable service with the axles stops. The car so equipped was I.C. Cafe-Lounge 4005, which has six-wheel, three-beam trucks with single-shoe brakes and 5 in. by 9 in. journals. All journals were between 4-15/16 and 5 in. in diameter with dust guard seats from 6 1/16 in. to 6 1/8 in. in diameter. The holes in the axle stops were 6 3/8 in. in diameter. The width of the stops was 8 3/4 in., the width of the dust guard wells 8 7/8 in.

Car 4005 was equipped all around with Axle Stops at the I. C. Burnside Shops on March 29, 1949. In September of that year all brasses and wedges were removed, cleaned and examined, and the boxes cleaned and repacked. At the second repack period, February, 1950, Brass No. 5 had a broken collar, and a new brass was applied at this location. Other brasses were reapplied. In this and the preceding inspection all brasses were marked to indicate the number of repack periods.

On August 24-25, wheels Nos. 11 and 12 were removed and new wheels applied. All journal boxes and parts were cleaned and carefully examined. Both brasses showed 1/32 in. outer end wear and 1/32 in. wear at fillet end. Linings showed no indication of distortion. Contacts were 3 1/4 to 3 3/4 in. wide through center of bearing 11, and 3 1/2 to 3 7/8 in. wide on No. 12. Axle Stops showed no wear; the hole was 6 3/8 in. both horizontally and vertically. The steel insert was not battered, wedges were OK.

Fig. 1 shows bearings and dust guards at locations Nos. 11 and 12. Fig. 2 shows dust guard seat of journal No. 11. New brasses and new wheels were applied at locations 11 and 12, the original brasses having made approximately 175,984 miles. The same dust guards were reapplied in original locations. There was no indication on the brasses removed of having contacted the side stops of journal boxes, or of contacting the inside dust guard well walls. Dust guard seats on the axle appeared to have slight built up metal from the steel inserts but were not scored.

Wheels Nos. 9 and 10 were also removed and all parts cleaned and examined after same mileage. Both brasses showed 1/8 in. wear on outer ends. Some lining squeezed



▲ **Fig. 2—The dust guard seats in August, 1950, had a slight build-up of metal but were not scored**

out on fillet end. Linings were not run and no contact had been made with side stops in the box. Dust guards showed contact having been made on one side only—that in the direction of brake thrust. The No. 9 stop showed 1/64 in. of rolled metal over an edge of steel insert, and showed contact had been made in two adjacent locations (Fig. 3). Dust guard seats on axle were in slightly better condition than those in locations Nos. 11-12.

Wheels Nos. 7 and 8 were removed and all parts cleaned and examined. Brass No. 7 showed journal contact 2½ in. wide outer end and 3¼ in. wide on inner end, on center line of brass. Brass No. 8 showed contact 2½ in. outer end, 3½ in. inner end, on center line of brass. There was no indication of brasses contacting side stops and no run linings; no end wear on outer end of either brass and only a mark on inner or fillet ends. New brasses were applied and those removed held for further inspection. These brasses had been applied on March 8, 1950, when wheels Nos. 7 and 8 were changed, and had run approximately 58,968 miles.

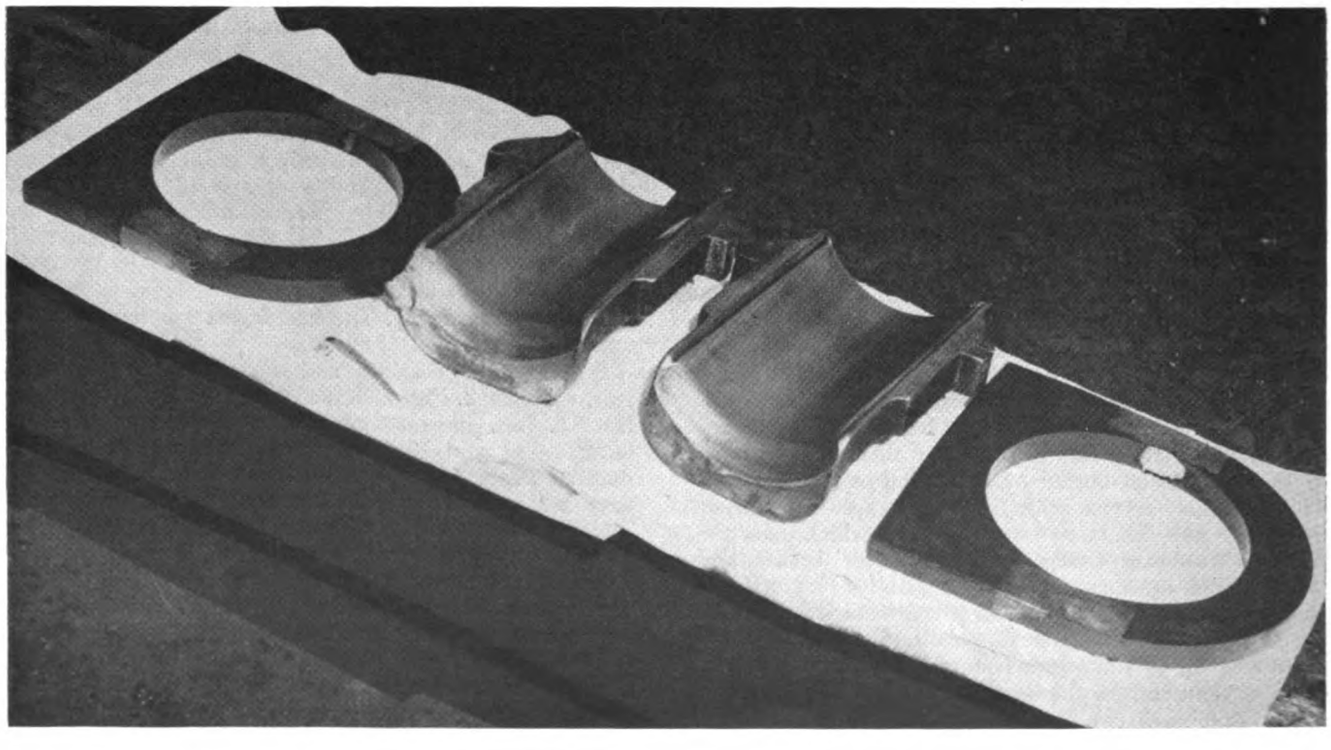
Boxes Nos. 1, 2, 3, 4, 5 and 6 did not have wheels dropped but brasses and wedges were removed, and all parts thoroughly cleaned and examined. No visible wear was noted on any of the axle stops in these boxes, observed from the outside. Brass No. 1, originally applied March 29, 1949, was renewed on account of some lining metal being squeezed out at fillet end—contact 3¼ in. wide, full length, on center line of brass. No contact of brass with side stops in box.

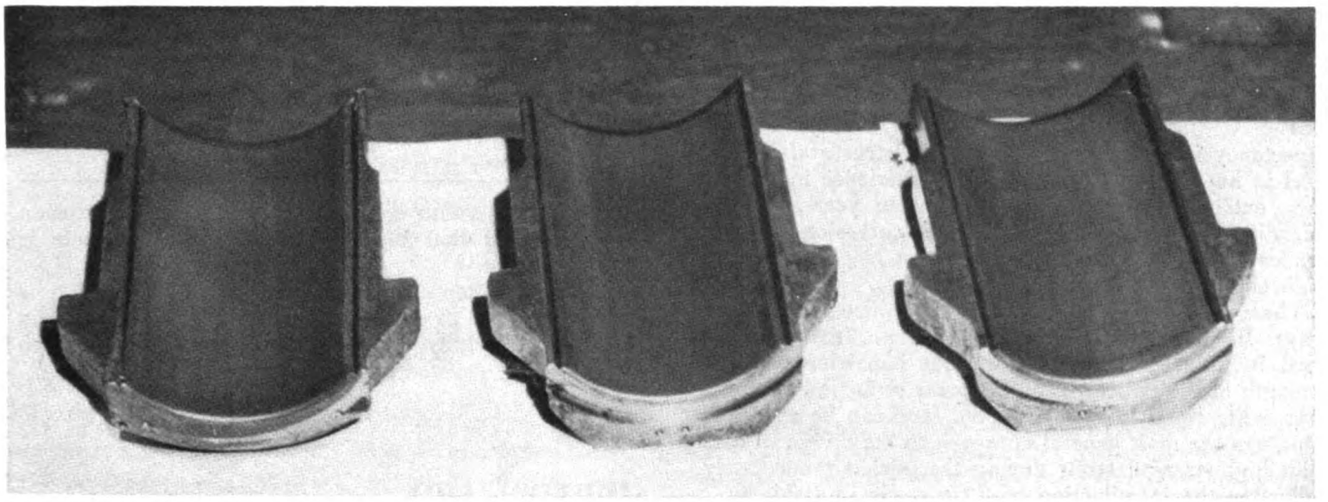
Brass No. 2 was removed account lining bearing metal squeezed out at fillet end. End wear was 1/32 in. on outer end; small piece of lining metal broken out, outer end, right side; no contact with side stops in box. Good contact—3¼ to 3½ in. wide through center of brass. Wedge OK. New brass applied.

Brasses and wedges, Nos. 3 to 6 were satisfactory and were reapplied.

The comparison car, I. C. Baggage Car 633, had the same type of trucks but without axle stops. Fig. 5 was

▼ **Fig. 3—Axle Stop 9 in August, 1950, is shown on the right; No. 10, on the left**





▲ Fig. 4—Brasses 11, 7 and 9 (from left to right), removed on account of changing wheels, typified the absence of double bearing seats and bruising on the sides of bearing from contacting the lugs in the journal box

▼ Fig. 5—Three brasses removed from Car 633, not equipped with axle stops, showing double bearing seats and bruising from contacting the journal-box lug



taken of three of the bearings removed from the 633 at repack on August 24, 1950. There were a total of five brasses removed from Car 633; the two not shown in Fig. 5 were removed for other causes. Each of the brasses in Fig. 5 showed lining squeezed out due to impact and brake thrust, and showed distinctly the double bearing on the surface of lining metal due to car movement, while journals were held out of center under brasses.

On March 13, 1951, after 312,000 miles with the axle stops, Car 4005 had wheels changed at box locations Nos. 3, 4, 5 and 6. The other boxes had the journal box packing removed and brasses examined for periodical repacking of journal boxes per A.A.R. Rule 66.

The dust guard seat of journal at box No. 3 location was smooth and in good condition. Dust guard seat on the journal at box No. 4 had slight scratches. The dust guard seats on the journals at boxes Nos. 5 and 6 had a very slight build up of metal which apparently was picked up from the inserts in the axle stops.

Journal bearings were removed at boxes Nos. 3, 4, 5 and 6 on account of the wheel changes and none were condemnable as to end wear, etc. All of these bearings except No. 5 had been in service since the test was started. No bearing had reached a full seat, indicating that the axle stops had kept the bearing centered on the axle.

Journal bearing No. 2 was removed due to the collar broken off back; otherwise this bearing was in good condition. Journal bearing No. 7 was removed due to collar end wear, but had a perfect seat on the journal and no indication of the lining being damaged on either side of the bearing. Journal bearings Nos. 9 and 11 were removed on account of fillet end wear.

Journal bearing No. 12 was removed through error. Since the car had already been returned to service the bearing was not put back after the error was detected. It was applied August 24, 1950, when wheels were applied at this location.

All of the journal bearings were tested by ringing with a hammer and all found to have the linings tight. The babbitt lining of all the bearings removed showed no indentations or marks indicating any wear on the side of the back or damage to the babbitt lining.

The axle stops in boxes Nos. 3, 4, 5 and 6 where wheels were changed were examined closely and found to be in good condition, with no noticeable change since last inspection. Visual inspection was made of the other Axle Stops, and from all appearances they were in good condition with no apparent change from the last inspection,

Rust—
How to Combat It

(*Continued from page 50*)

expectancy is about 1½ times that of structural carbon steel in hopper car service. Service experience in hopper cars, extending over the past seventeen years, is now affording evidence that the more corrosion-resistant grades of high-strength steels last about 1½ times longer than copper steel.

These high-strength steels can be utilized in several ways. Because of their greater strength, they can be used in reduced thicknesses without impairment of the strength of the structure. With proper reduction in thickness a life equal to that of copper steel can be expected. This was the most general approach to the design of cars with high-strength steels during the period immediately following the introduction of these steels in 1934.

On page 109 of the Carbuilders' Cyclopedia of 1937 there was a brief statement on trends in car construction which read as follows: "At the present time there is a marked tendency toward decreased freight car weights obtained by the use of alloy high-tensile steels and by refinements in designs, not only in the car itself but also in detail parts."

Weight savings up to 3½ and even 5 tons per car were obtained with the high-strength steels, making available a corresponding increase in pay load capacity. The extra cost of material was largely offset by the reduction in weight of steel required, so that the first cost of a car was nearly equalized.

In recent years the trend in the use of high-strength steels has been quite definitely toward their utilization in the same and even greater thicknesses than have been common practice with copper steel.

The cost of major repairs has risen so high that it has become of vital importance to extend the time between shoppings. It is here that the corrosion-resistant high-strength steels can make a substantial contribution by providing extra life, the extension depending upon the thickness used.

A recent study of the extra cost f.o.b. mill, of the side, end and floor sheets of A.A.R. standard hopper cars in contact with the lading gave the comparison between copper steel and USS Cor-Ten in the same thicknesses shown in Table I.

With the time between major repairs increased 50 per cent with high-strength steel, it is evident that there will be two renewals in copper steel for one in high-strength steel. Taking the items of cost for a 70-ton car and including the original steel, the copper steel would cost 3 x $502.50=$1507.50 and the total for USS Cor-Ten would come to 2 x $708.55=$1417.10. There is a saving of $90 in the cost of material in addition to a saving in the fabricating cost of one major repair (usually about 500-850).

The aim of this discussion has not been to propose specific designs, but rather to suggest a method of approach to corrosion problems through a knowledge of how corrosion occurs in different environments. One can always learn much from examining structures with a critical eye and mind to determine, if possible, the underlying causes of whatever corrosion is found.

Corrosion protection costs money, but neglect to take it into account will often prove more costly still. When first cost is made the deciding factor, there is no assurance that, in the long run, the total cost will be a minimum. So long a time elapses before the costs of corrosion are developed that the temptation to procrastinate is always present.

This much can be said in conclusion. Corrosion is still a challenge to everyone concerned with the problem it creates and fully warrants all the study and research that is being devoted to its reduction.

Table I—Comparative Costs of Hopper Car Sheets in Contact with Lading

Capacity of car	Cost of Material: Copper steel*	Cost of Material: U.S.S. Cor-Ten*	Extra cost of U.S.S. Cor-Ten
50 ton	$393.31	$554.59	$161.28
70 ton	502.50	708.55	206.05

*Same thicknesses in both steels

Journal Box Wedge Reclamation

Journal box wedges are reclaimed for about one-eighth the cost of a new wedge by re-forging the 78-in. radius across the top. The operation is performed on a 5-in. Ajax horizontal forging machine. The side dies are the shape of the wedge and the stationary die has a 78-in. radius. The moving die is straight with a bulge 3¼ in. wide by 2¼ in. long and 1/16 in. deep. This budge applied to the journal side of the wedge reforms the wedge with the 78-in. radius on the top without disturbing the bearing surface.

This operation is currently being performed on wedges for 80,000-lb. cars and for 100,000-lb. cars.



Reclaiming a journal box wedge by re-forging the 78-in. radius across the top

The bulge in the die is the same size for either capacity wedge. The bearings are heated to between 1,550 and 1,600 deg. for the forging operation, which is done at as low a temperature as practicable to reduce the amount of scale formed. After forging the wedges are wire brushed by hand and ground.

Engine Oil Pressure*

The lubrication system is an engine's life line and malfunctioning may lead to serious failure. The significance of oil pressure as an indicator is the basis of this discussion

P. A. Binda†

USING the same unit in the second test, oil temperature was maintained constant at 130 deg. F. and pump speed varied using oils P-3 and N-3S again. The pressure data obtained are shown as Figure 8. These curves show that discharge and line drop pressures increased with increased oil flow. Although the differences in respective pressure values between the two oils are considered to be of little significance, the relationship again showed lower discharge and line drop pressure for the lower viscosity oil at equal flow rates. These results agreed with the equation of flow. Since for any one discharge pressure the oil flow rates were not equal even though the differences in flow rates are of no practical value, it is apparent that the oil pressure gauge reading alone did not indicate the quantity of oil flowing.

From Fig. 9, where pump speed was varied with constant oil temperature and the viscosities of both oils were sufficiently high it is apparent that the system did not recognize oil VI and output was a linear function of speed. However, oil pressure increased with output as discussed in Part I.

From these data it appears that high and low VI oils show little or no pressure difference at temperatures associated with normal engine operation.

*Part II of the abstract of a paper appearing in the Texas Company's technical publication, Lubrication, March, 1951.

†Technical & Research Division, Texas Company

The Reynolds Number was calculated for the maximum flow condition to determine what type of flow was being obtained. A value of 0.04 was obtained which, being less than 0.141, the critical value, indicated that laminar flow was experienced in all cases.

Actual Engine Oil Pressures

These simple tests indicate that normal equations of fluid flow are applicable to an engine lubrication system. Therefore, in an actual engine, oil pressures should be affected by the following factors:

1. Oil pressure should vary with oil viscosity or, since viscosity varies inversely as a function of temperature, oil pressure also should vary inversely as a function of oil temperature.
2. Oil pressure should vary with flow, or since pump output varies with speed, oil pressure should also vary with engine speed.
3. Oil pressure should vary inversely as a function of outlet size (oil passage clearances) in the system or, oil pressure also should vary inversely as a function of wear.

Oil pressure-engine speed relationships were determined in a gasoline engine for one oil at various crankcase temperatures and a constant jacket temperature. The data obtained are shown as Figure 14. It is apparent that in this case oil viscosity based on crankcase temperature

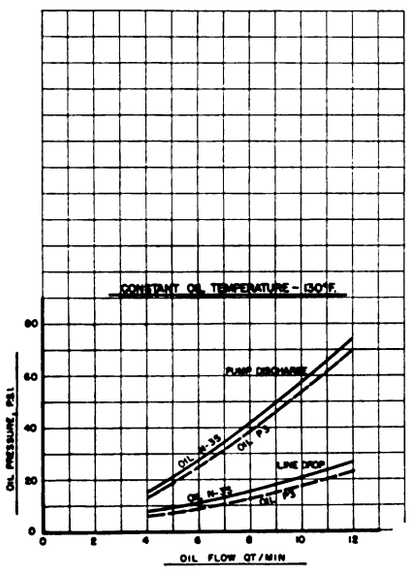


Fig. 8—Oil pressure-flow relationship for a simulated lubrication system

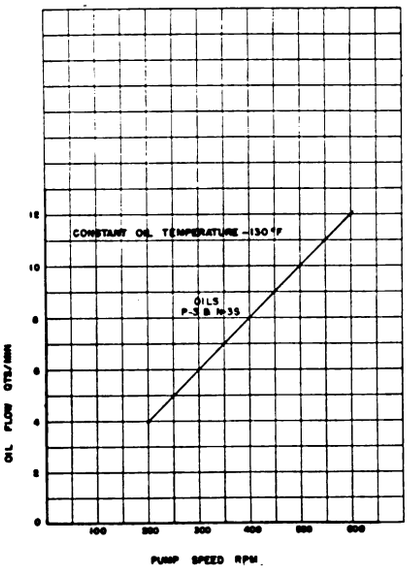


Fig. 9—Oil flow-pump speed relationship for a simulated lubrication system

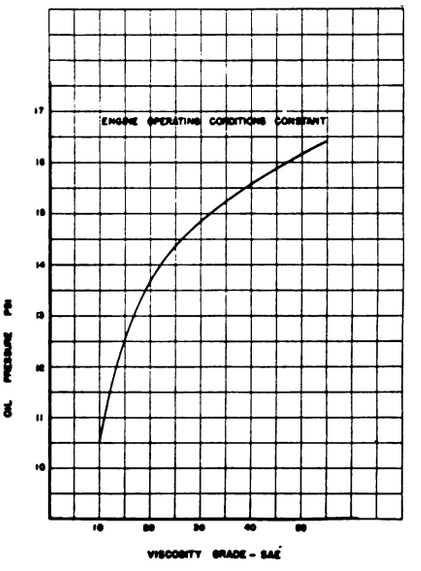


Fig. 10—Oil pressure-viscosity relationship for a gasoline engine

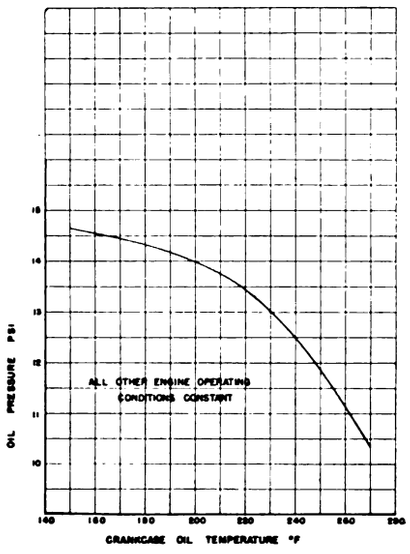


Fig. 11—Oil pressure-temperature relationship for a gasoline engine

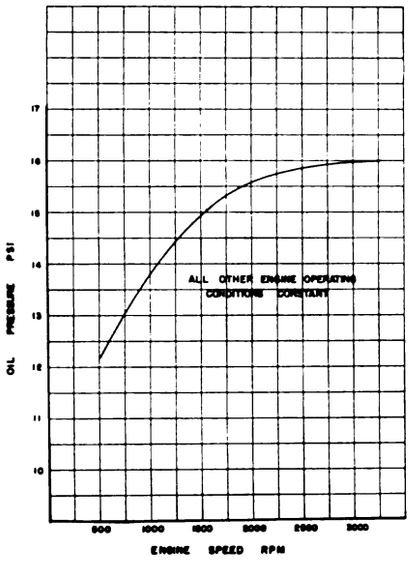


Fig. 12—Oil pressure-engine speed relationship for a gasoline engine

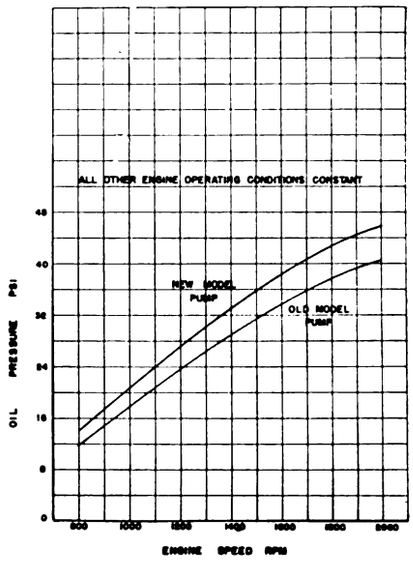


Fig. 13—Oil pressure-engine speed relationship for a Diesel engine

had little or no effect on oil pressure except at idling speeds although the engine speed effect was noted. At first, it would appear that perhaps the data are wrong or the equations of fluid flow do not apply. However, further data were obtained on this engine to better visualize what occurred in the oil system. Oil gallery temperatures were determined throughout the engine speed range at three different jacket temperatures with the crankcase oil temperature maintained as low as was possible (110-120 deg. F.). The oil gallery temperatures are shown as Figure 15. It is quite apparent that jacket temperatures had a marked effect on controlling oil temperature in this engine. Other engines also have their particular characteristics relating jacket and oil temperatures. These data show that the oil temperature is not constant throughout the lubrication system, therefore, oil viscosity also varies throughout the system. The equations of flow are vaild in the engine but become more complex to apply since oil viscosity varies along the flow path.

When oil pressure data such as obtained in a Diesel engine as shown in Table II are encountered it would be unwise to adhere to the existing belief that low oil pressure always indicates defective lubrication.

Operators who believe this and use a higher viscosity grade oil in an effort to increase oil pressure may not overcome their problem as will be shown subsequently.

The data in Table III were obtained at constant speed and load conditions in a railway Diesel engine wherein the jacket coolant is used as the coolant for oil heat exchangers.

The effect of jacket temperature on oil temperature is apparent. Since temperature inversely affects viscosity the engine oil pressure reflected the reduction in viscosity. Although oil flow rates were not determined in this engine the increased pressure drops through the engine with decreased viscosity were associated with increased oil flow. These data show that the effect of jacket temperature on oil pressure is markedly different for different types of engines.

Oil pressures for all of the oils shown in Table I were determined in an automotive gasoline engine that was

TABLE II

Water Temperature, °F.	*Constant Speed Oil Pressure, PSI*
150	50
170	40
190	30

TABLE III

Jacket Temperature, °F.	*Oil-Temperature, °F.*	*Oil Pressure, PSI To Engine*	*Drop in Engine*
104	120	61	5
134	156	60	8
141	164	60	13
164	186	57	15
191	214	53	19
200	240	50	23

in good mechanical condition. Data were obtained at various speeds while other engine operating conditions were maintained constant. Then the oil pressure determinations were repeated using the same oils and the engine equipped with an oil pump that had .010 inches wear on the face of the drive gear and .008 inches increase in backlash between the gear teeth. The results obtained on the basis of oil pressure versus oil viscosity at 210 deg. F. are shown as Figure 16.

It is apparent that with the normal pump at the various speeds shown, oil viscosity grade had very little effect on engine oil pressure. The greatest effect was shown at the highest speed and that was less than 4 p.s.i. over the whole viscosity range. The increase in pressure variation with increase in engine speed was associated with pump characteristics. Also, pressure was a function of viscosity rather than type of base stock or VI.

With the worn pump in the highest speed range (lower of upper pair of curves) a consistent reduction in oil pressure was experienced through all the S.A.E. grades. This is reasonable since the excess capacity of the oil pump maintained the same relative order of pressures

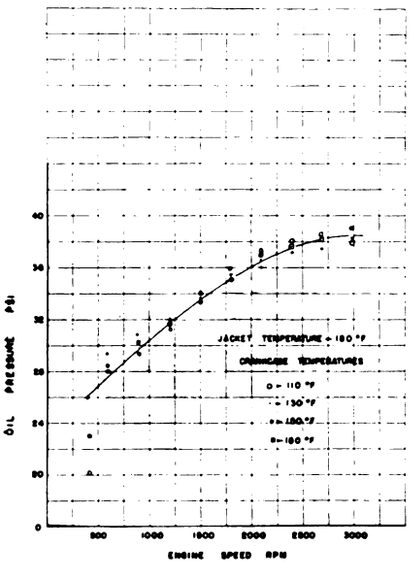


Fig. 14—Oil pressure-engine speed relationship for a gasoline engine

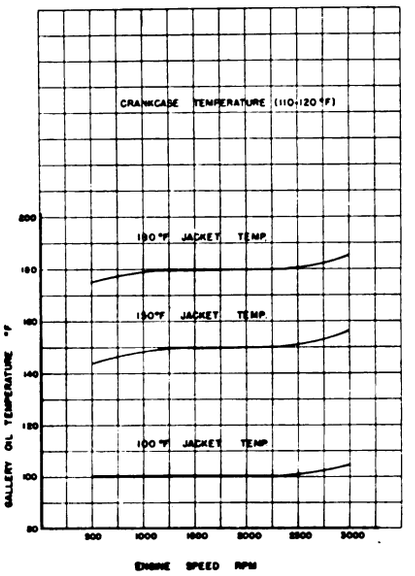


Fig. 15—Effect of jacket temperature on oil temperature in a gasoline engine

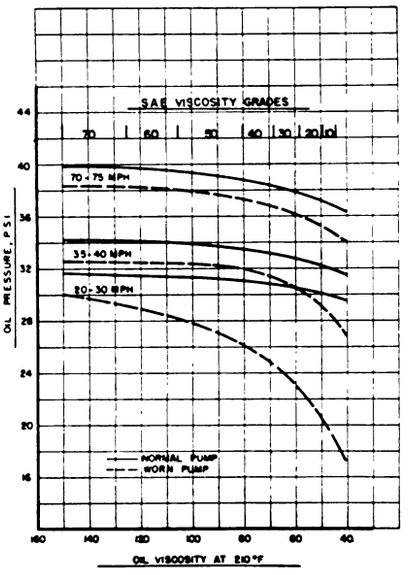


Fig. 16—Oil pressure-viscosity relationship for a gasoline engine

which reflected the slip loss in the pump resulting from the wider clearances. As speed was reduced, using the worn pump, oil pressures were lower and showed a further decrease with decreasing S.A.E. grade. In the lowest speed range shown the possibility of insufficient flow rate for proper lubrication and cooling existed with oils below an S.A.E. 40 grade since the manufacturer specifies a minimum of 25 p.s.i. oil pressure at these speeds.

These results indicate that at normal engine operating temperatures the effect of viscosity on oil pressure is relatively small when the engine and pump are in good mechanical condition. However, if large engine oil pressure changes are experienced with minor viscosity changes, it is an indication that an unsatisfactory mechanical condition exists.

Oil Pressure Related To Flow

That a reduction in oil pressure means an increase in flow in the engine system is usually accepted as fact, however, this is true only under certain conditions. Considering the oil pump, a reduction in outlet pressure increases volumetric efficiency, however, in the range of engine oil pressures normally experienced, this increase of efficiency is small and would increase flow only slightly. Considering the engine, the only factor that affects pressure is viscosity. However, in the normal operating range of crankcase temperatures there are only small changes in viscosity, therefore, also in pressure.

In the case where pressure drop is due to enlarged clearances, such as bearing wear, flow will increase through the enlarged clearances (Equation 3) but the total flow in the system remains the same except for the following condition.

Engine oil pumps are normally designed to have excess capacity to take care of normal engine wear or enlarged clearances. To avoid excessive pressures while the engine is new a by-pass arrangement controlled by oil pressure is incorporated in the system. If either a change in clearance or viscosity occurs that reduces pressure below the pre-determined setting of the by-pass control, the by-pass valve closes diverting more oil to the engine galleries, assuming, of course, that the oil pump has excess capacity. The increased flow tends to restore oil pressure (Equation 1). If conditions arise that increase viscosity, or clearances are reduced, the process will reverse itself. Also, the condition can exist whereby the by-pass line is not sufficiently large to take care of all the excess flow; then the oil pressure gauge will indicate a pressure rise above the control setting which registers the restraint to increased flow (Equation 1).

In a worn engine or with a worn pump such as shown in Fig. 16, it is apparent that at high speeds the pump still had sufficient excess capacity to override the control pressure setting of 30 p.s.i., however, at lower speeds there was insufficient capacity to maintain pressure. The drop in pressure experienced did not mean more oil was flowing. Also, the reduced pressures may not have been a reflection of lower oil viscosity alone but also a reduction in flow (see Fig. 7). In all of these cases it is apparent that the oil pressure gauge did not necessarily indicate the rate of oil flow.

Factors Affecting Viscosity

Oil viscosity in an engine is affected by fuel dilution and heat which reduce viscosity, and by oxidation or contamination with solid or tarry materials which tend to increase viscosity. However, if dilution, oxidation or contaminant products present in engine oil change the viscosity of the oil the equivalent of more than one S.A.E. grade, then either oil change periods are too extended or improper operation or performance of the engine are indicated. From Fig. 16 it may be noted that a change of one S.A.E. grade in the engine with a normal pump resulted in less than a one p.s.i. change in oil pressure which cannot be detected readily on most engine oil pressure indicators.

Increasing viscosity grades in a rotating journal and bearing combination results in an increase of heat generation from oil film shearing with increasing oil viscosity. Accordingly, this increases the temperature of oil returned to the bulk oil to be supplied to the bearing.

TABLE IV

Oil	*P-3C*	*N-4A*	*P-3*	*N-5*
VI	102	63	97	0
Engine Speed, RPM		Oil Pressures, PSI		
1200	32.3	33.3	32.0	32.2
1800	35.4	35.8	34.0	36.0
2400	36.4	37.0	36.5	37.2
3000	38.0	38.8	38.0	39.0

TABLE V

Oil	*Vis. S US at 210° F.*	*VI*	*Oil Pressure, PSI*
A	68.9	0	47
B	77.0	56	54
C	75.2	61	50
D	79.5	86	51
E	80.0	92	47

Therefore, the net effect is a tendency for the changes in oil temperature to offset the viscosity effect shown in Fig. 16 which was determined at a constant temperature. Of course the inclusion of an oil cooler in the system would alter this condition.

Effect of VI On Engine Oil Pressure

A question is usually raised regarding the effect of VI on oil pressure since a low VI oil decreases in viscosity more rapidly than a higher VI oil as temperature increases. In the discussion above it has been pointed out that viscosity is the controlling factor, therefore, it would seem that differences in VI would have an effect. However, in the temperature ranges associated with normal engine operation the viscosity difference between oils of different VI's in the same grade are relatively small, therefore, there should be very little difference in engine oil pressure. This is substantiated by data obtained in an automotive gasoline engine at constant 180°F. jacket and 190°F. oil temperatures with oils of approximately equivalent 210°F. viscosity but different viscosity index. (Table IV.)

It is apparent that VI had little or no effect on the engine oil pressure under normal operating conditions. Similar data (Table V), from a railway Diesel engine again show that the lubrication system did not recognize VI during normal operation at 240°F. oil temperature and 200°F. jacket out temperature.

It is recognized that at low oil temperatures, such as when starting a cold engine, differences in VI are reflected by differences in oil pressure since engine oil pressure is a function of viscosity. Under these conditions of engine operation the importance of using the proper viscosity oil to relieve peak cold oil pressures and increase flow is apparent.

On starting a cold engine (oil cold) a marked increase in oil pressure may be noted. This is a viscosity effect. As the engine warms up the oil viscosity is reduced and oil pressure should drop to normal. If this does not occur in a reasonable length of time, immediate action should be instituted to determine the cause of the high pressure. Conversely, if soon after starting an engine, oil pressure is not indicated the engine should be shut down and the cause of no oil pressure determined.

Detergent or Dispersive Oils

It has been noticed that a change in oil pressure sometimes results after changing from a straight mineral oil to a detergent or dispersive type. It is well known that these oils have a reasonable purging action in an engine. Loosened deposits may clog oil pump screens and intake lines causing reduced oil flow and reduced pressure or they may get by the pump and clog oil galleries increasing oil pressure by limiting oil flow. By cleaning deposits from worn bearing and pump clearances, the increased leakage can cause an oil pressure decrease. It is obvious that some precaution should be exercised in changing from a straight mineral to a detergent and/or dispersive type oil in a used engine. None of these effects were ever noted by changing to a detergent or dispersive oil in newly overhauled or new engines that were in good mechanical condition.

As mentioned previously the oil in a pressure lubricated engine also serves as a coolant. It is therefore desirable to have as high a rate of flow as possible consistent with the amount of oil control provided by the power section of the engine, otherwise excessive consumption can result. An increase in flow resulting from increased bearing clearances can result in lowered oil pressure and may appear to be beneficial from its heat carrying standpoint, however, this may be greatly offset by loss of oil control and the attendant high oil consumption.

Oil Pressure Indications of Engine Malfunctioning

The above discussion and points set forth are not intended to mean that changes in oil pressure are detrimental to engine operation. Most engines in good mechanical condition, operating under a fixed set of conditions and using a specified viscosity grade oil will show a definite oil pressure indication. If, after continued use under the same conditions a change in oil pressure is noted, it is a good indication that something in the lubrication system is not normal. The most common change is that of reduced oil pressure. The amount of reduction that can be tolerated is dependent on the engine design. In some engines relatively small reductions may lead to malfunctioning while in others rather large reductions may not necessarily cause failure although this is not considered to be a desirable condition.

Knowing the engine characteristics with regard to engine oil pressure it is possible to associate engine mechanical malfunctions with deviations from normal engine oil pressure. Some of these malfunctions and their effect on oil pressure are shown in Table VI.

Trends In Lubrication System Design[1]

One of the most important individual problems in a modern automotive engine lubrication system is the journal bearing. A section of a journal bearing with a polar diagram of the oil film pressure is shown as Fig. 17.

With gravity feed the oil is usually introduced between *A* and *B* and must pass through the region of larger journal clearance to arrive at *C* where it is available to form the oil wedge. Much oil may be lost as leakage while passing through the large clearances.

This oil may not only be lost for lubrication but may be ineffective for cooling. In a pressure system oil may be introduced nearer point *C*, thereby reducing end leakage and having a maximum amount of oil contacting the bearing surfaces for cooling.

The effective length of a bearing is proportional to the length of the area of high oil film pressure (length *A* Fig. 18. The ineffective length caused by end leakage is constant regardless of bearing length, therefore, any change in bearing length affects the high load area directly. Although the change is a small per cent of total bearing length, it can be an appreciable per cent of the

[1] October, 1946, "Wil-Rich Forum". Published by Eaton Manufacturing Company.

Note: Figs. 17 to 25 inclusive, are through the courtesy of the Eaton Manufacturing Company.

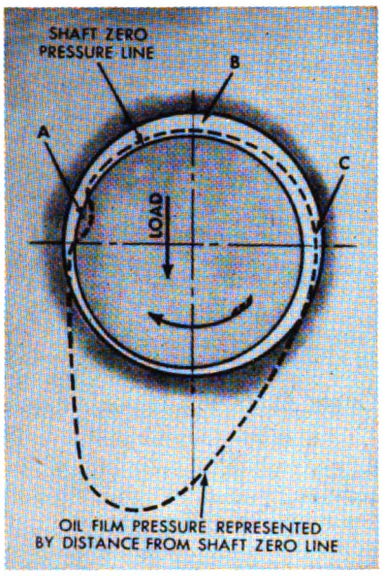


Fig. 17—Section of a journal bearing with polar diagram of oil film pressure

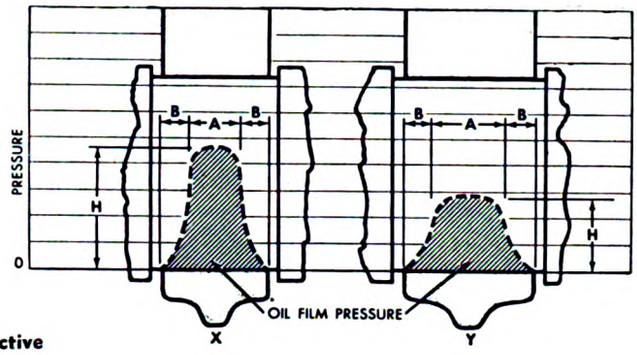


Fig. 18—How the effective length of a bearing is proportional to length of area of high oil film pressure

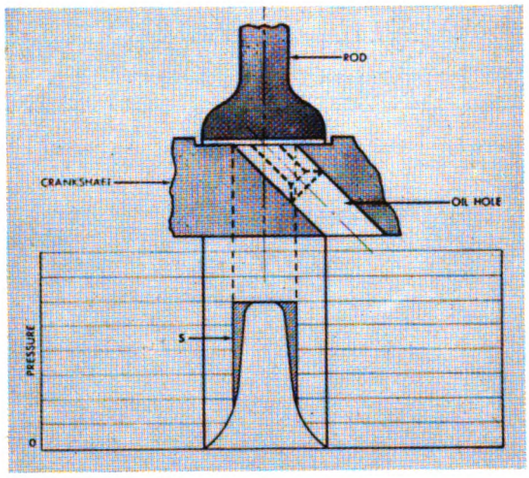


Fig. 19—Modern practice of drilling an angular hole from the main bearing to feed the rod bearing

high load area and greatly affect the load carrying capacity. This is illustrated in Fig. 18 wherein two bearings of different lengths carrying the same load are shown. The oil gradient *B* is equal, however, compare *H* and note the difference in bearing pressure.

From the standpoint of bearing cooling it is essential that end leakage oil does some cooling by passing over the journal. However, in some designs the use of an annular groove combined with a longitudinal dirt slot may carry the oil away before it can exert any beneficial cooling.

The modern practice of drilling an angular hole from the main bearing to feed the rod bearing, as shown in Fig. 19, may, in the case of a narrow bearing, remove most of the end seal. The dotted lines are a suggested practice to increase the end seal, adding greatly to the cooling oil contact as well as directing the oil pressure to the loaded bearing oil wedge rather than to its gradient leakage edge. The shaded area *S* in Fig. 19 represents an oil loss resulting from the large oil feed hole.

Some recent studies have shown that the load carrying capacity of a bearing is greatly increased when the load rotation is opposite to the shaft rotation as is the case during the highly loaded portion of the cycle of a rod bearing. Also a bearing can support an instantaneous load much greater than the average load under which it will fail.

Lubrication System Pressures

Fig. 20 shows (A) a schematic diagram of the primary lubrication system in an engine; (B) the effect on pressure of locating the pump and by-pass at the center of the oil gallery; and (C) the effect on pressure with the pump at one end and relief valve at the opposite end of the gallery. The dotted lines indicate pressure gradients for cold oil temperature while solid lines are for normal temperature conditions. In the former (B) peak cold oil pressures are controlled by a reduction in flow while in the latter (C) consideration must be given to line size to keep cold oil pressure and resulting pump drive torque

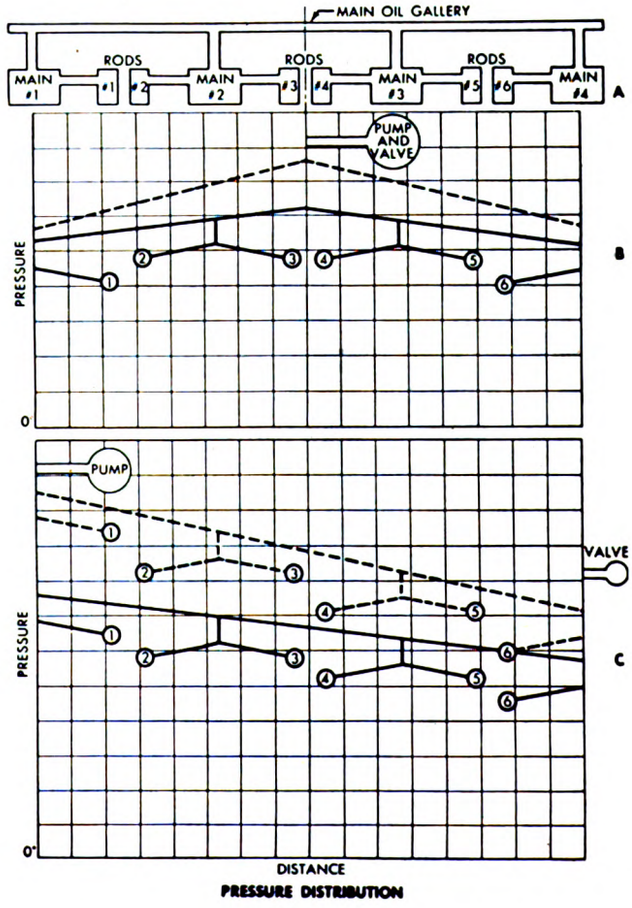


Fig. 20—Schematic diagram of the primary lubrication system of an engine

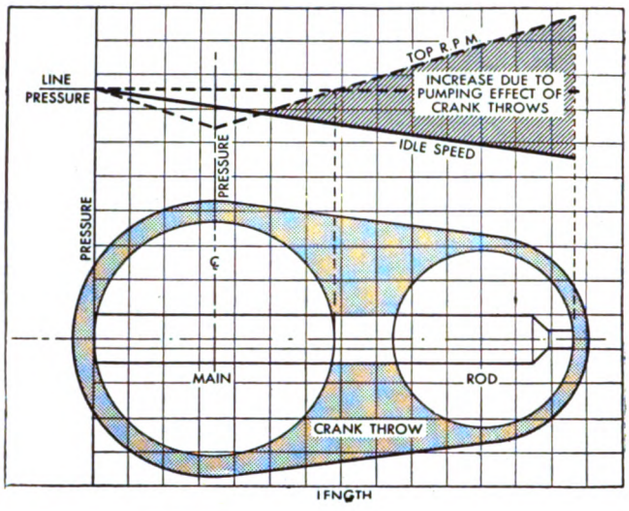


Fig. 21—Pressure relationship between main and rod bearings

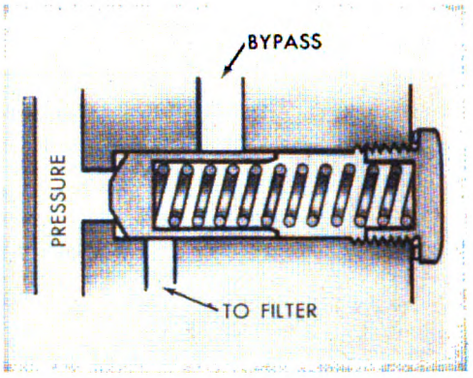


Fig. 23—A type of shut-off valve

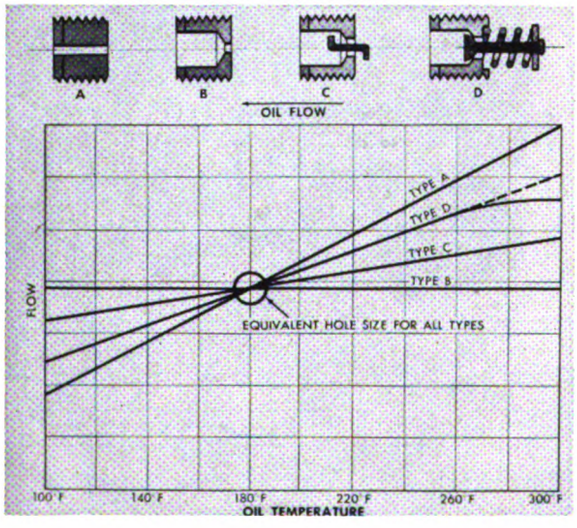


Fig. 22 — Secondary lubrication can be provided by bleed holes

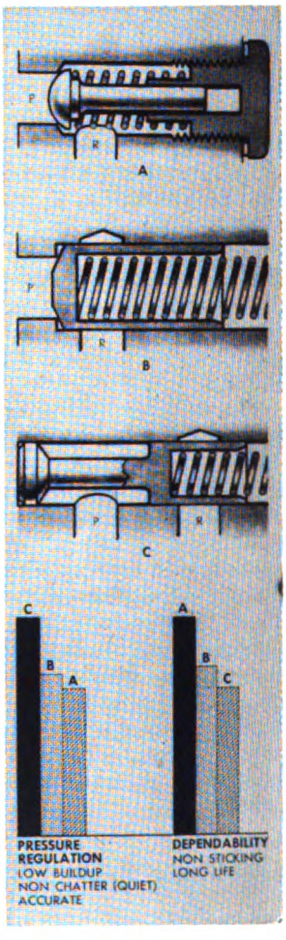


Fig. 24 — Three types of relief valves

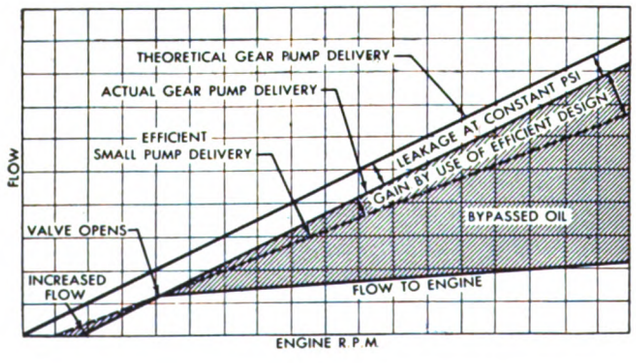


Fig. 25—Oil pump performance data

within a reasonable limit. However, there is a gain in oil flow because of the increased pressure.

The pressure relationship between main and rod bearings is shown as Fig. 21. The centrifugal pumping effects of the crank throws increase the oil pressure at the rod bearing, thereby increasing the flow of oil. The oil pressure at the rod bearing increases as the square of the speed to approximately 30 p.s.i. at 4000 r.p.m. Bearing temperature varies almost directly with speed. Therefore, an increase in oil flow occurs as cooling needs increase.

Secondary Lubrication

Secondary lubrication is usually provided via bleed holes; four general types are shown with corresponding flow curves as Fig. 22. The orifice size should be determined for the most normal operation temperatures, however, Type A orifices are usually determined at cold

oil temperatures with a resultant increase of flow at the higher temperatures. The knife edge orifice Type B has a discharge nearly independent of viscosity. By using smaller hole diameters more oil is available in the primary system under cold temperature conditions.

A design to decrease danger of dirt fouling, by means of the action of a free piece of wire, is shown as Type C. In this type, hole size can be reduced in view of its annular nature and less danger of clogging whereas in the straight hole type, size of hole is limited to drill size rather than determined by actual oil flow. A shut-off type used to confine oil to the primary system up to a certain pressure, which is usually low, and may be designed to give variable flow, is shown as Type D. This type is often used to isolate the oil filter from the engine at low speeds or it may be incorporated in the engine relief valve as shown in Fig. 23.

It cannot be emphasized too strongly that a squirt hole of 3/32 inch, for ease of production, can actually rob the vital engine bearings of a major portion of engine oil pump flow. Even a 1/16 inch hole is usually too large and a loss through it represents three times as much oil flow as is given to any vital engine bearing. A larger pump capacity cannot always rectify this squirt hole loss. At engine idle with hot oil a 6 g.p.m. at 2000 r.p.m. pump will deliver 0.3 g.p.m. A 10 g.p.m. at 2000 r.p.m. pump will deliver 0.5 g.p.m. at idle. The 1/16 inch hole will flow 0.3 g.p.m. at 50 p.s.i., therefore, pressure cannot be achieved with a 6 g.p.m. pump. With a 10 g.p.m. pump, even if the engine should be tight enough to maintain pressure with a 0.2 g.p.m. flow to the bearings, less than half flow is available for the bearings. There seems to be no compromise from a small properly proportioned oil hole in combination with an efficient pump.

Relief Valves

There are two general types of relief valves, those which by-pass to the sump and those which return oil to the pump intake. These are also divided into wet or dry types, depending on whether they drain dry during periods of non-operation.

With a relief valve incorporated in the pump housing it is usually most convenient to by-pass to the pump inlet. Therefore, the valve should be of the wet type and non-sticking to prevent air leakage and loss of pump prime.

To assure priming, by-passing to the sump would be preferable. The valve can then be wet or dry and sticking not be a priming hazard. If possible the return should be below the oil level to decrease aeration and foaming.

Three types of valves that have proven satisfactory are shown as Fig. 24. Selection, variation and combination of these designs should be to meet the desired characteristics. Types A and B are low pressure types having a larger seating area exposed to pressure when open than when closed, thereby causing the valve to hunt under critical conditions; this may be disastrous in a high pressure system. Type C overcomes this, however, in view of the close fits required, the oil must be kept exceptionally clean.

Aside from dirt, lacquering is a common cause of relief valve sticking. Type C is the worst offender under these conditions. By increasing outside diameter clearances Type B can be improved while Type A is loose and is least affected. Type C is best for accurate pressure control and quietness.

TABLE VI—CONDITIONS AFFECTING OIL PRESSURE

Some factors affecting oil pressure and their indication on the oil pressure gage are as follows:

	Pressure Gage Indications
1. Faulty gage	High or low
2. Clogged line to gage	No movement or delayed action
3. Clogged oil pump screen	Low
4. Faulty oil pump	Low or erratic
5. Excessive main, con rod, camshaft or rocker arm arm bearing clearances	Low
6. Clogged full flow filter (provided by-pass is inoperative)	Low
7. Insufficient oil filter restriction	Low
8. Ineffective oil cooler, depending on type, may keep oil too cold or provide insufficient cooling	High or low
9. Crankcase oil level just at or below oil pump pick-up	Erratic, then low, eventually none
10. Use of excessively low viscosity oil	Low
11. Use of excessively high viscosity oil	High
12. Excessive fuel dilution	Low
13. Excessive contamination	High
14. Clogged oil passages on the pressure side	High
15. Enlarged squirt holes	Low
16. Impr oper setting or failure of pressure relief valve	High, low or erratic
17. Oil lines or line fittings broken, cracked or loose	Low
18. Oil pump drive gears stripped or drive broken	Low, erratic or none
19. Oil too cold	High
20. Restrictions in oil pan or oil too viscous to keep oil pump intake supplied	Low or erratic
21. Oil pump pick-up stuck high	Low or none

Oil Pumps

Engine designers have increased lubrication points as they have become lubrication conscious but with modern auto styling oil pans have been reduced in size, thereby limiting the size of oil pump that can be installed. Therefore, the problem cannot be solved by merely increasing pump size. In the past large manufacturing tolerances were employed resulting in large pump clearances despite the fact that in a capillary-sealed pump the leakage varies as the cube of the clearance. The pump was selected so that the discharge equaled requirements.

It is usually desired to reach relief pressure by 1,000 engine r.p.m. (500 pump r.p.m.) and if possible maintain full pressure at idle or at a time when pump efficiency is lowest. From Fig. 25 it can be seen that the leakage of a conventional gear pump is constant at a given pressure so that at a lower r.p.m. leakage forms a larger portion of the total discharge. Thus a pump with 80 per cent efficiency at 1,000 r.p.m. (pump) has 20 per cent efficiency at 250 r.p.m. The dotted lines in Fig. 25 show the performance of a smaller pump with good low speed efficiency. It was designed to give the same flow as the first pump at the r.p.m. at which the relief valve opens. As a result it gives more oil up to the point at which the valve opens and less by-passed oil beyond this point. This action can also be applied to giving more oil throughout the low speed range without increasing top flow and pump drive power.

Conclusion

The lubrication system is the life line of an engine; any malfunctioning in this system may lead to serious engine failure. Therefore, it is a primary requisite in engine operation to maintain the lubrication system in good condition and to use the proper lubricating oil to obtain maximum service from the engine. Engine oil pressure is used to indicate oil flow in the lubrication system, but at times the significance of variations in engine oil pressure is not completely clear, therefore, before conclusions are drawn regarding changes in engine oil pressures, the characteristics of the engine with respect to oil pressure and/or previous experience on the engine in this respect should be ascertained.

Press Removes Hyatt Outer Races

Removal or application of Hyatt roller bearing outer races for inspection or renewal of wear plates is accomplished in from 15 to 30 seconds on a press built at the Pegram shops of the Southern at Atlanta, Ga. The press consists of a suitable frame and two double-acting hydraulic cylinders. The top cylinder is 6 in. diameter with a 14-in. stroke and the bottom cylinder 8½ in. diameter with a 2-in. stroke. The bottom cylinder is larger in diameter than the top to hold the journal box in position against the pressure of the top cylinder when pressing the race in. This is necessary because the box is supported on the bottom piston shaft during application of the race. The support is through a ball joint to compensate for any irregularities in the outside surface of the box. The box is held in place when pulling the outer race by a fixed center plate. It is moved back and forth on a four-wheel cart in the center of which a hole has been cut so that the bottom hydraulic piston can contact the box directly.

In pressing the outer race out the box is loaded on the cart either by an overhead crane or by a jib crane. The cart is rolled over the bottom piston and the piston raised until the inner face of the box contacts the center plate, and the opening in the box is aligned with the 12¾-in. hole in the plate. A shaft extension is keyed to the top piston rod of the press, and a pulling piece mounted to the shaft with a pin. The pulling piece is 4½ in. by 9½ in. with the edges rounded off to the diameter of the race. It removes the race through engagement with the bottom edge. The overall time for the operation, including all set-up work, averages from 3 to 5 minutes.

For pressing a race in, the box is mounted on the cart as before but is supported on the lower piston through the hole in the cart. A plate 12½ in. in diameter and keyed to the top piston rod contacts the top of the outer race and presses it in until it seats against the filler piece of the box.

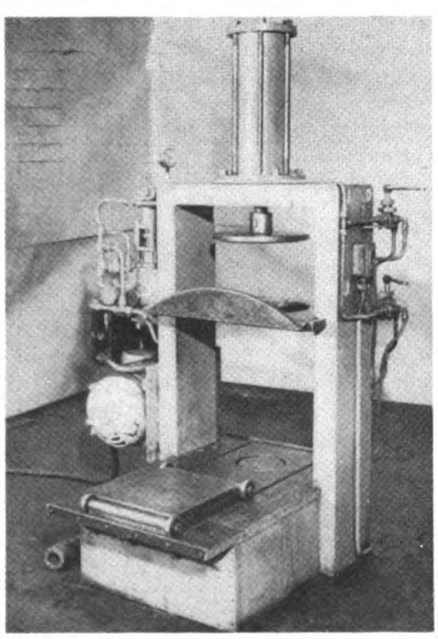
Construction Details

The cart which supports the box for aligning with the hydraulic cylinder and during the pressing out operation of the race rides on four steel wheels ⅝ in. by 2½ in. in two slots ¾ in. by ¼ in. in the base of the press. The cart body is 11¼ in. wide by 13 in. long. The opening through which the box is supported on the lower piston when the race is being pressed in is 7½ in. wide and irregularly shaped lengthwise.

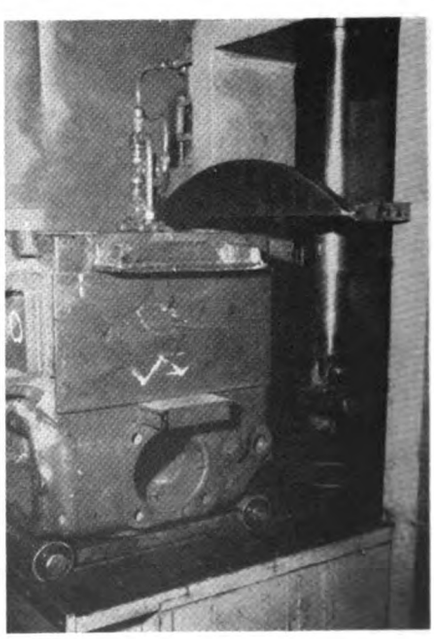
The center plate which restrains the box while pressing out the race is made of 1 1/16-in. plate with two flanges added for rigidity. A second press to be built will have a 1½-in. plate and no flanges. The bottom of the plate is 21 in. above the base of the press, and it is 13¼ in. from the top of the plate to the bottom of the top frame member. The distance from the sampson to the bottom of the plate which presses the liner in is 10¼ in. The filler plate used for height adjustment with the bottom hydraulic cylinder is 11¼ in. by 12¼ in. by 1¾ in. The need for this plate will be eliminated on the new press which will have a 4-in. stroke on the bottom cylinder, in place of the 2-in. stroke on the present bottom cylinder.

The columns of the press are steel forgings 3 in. by 9 in. on which the hydraulic cylinders are bolted in place. A slot 1 in. deep is cut into the side and the center plate fits into and is supported by these slots. The pumping pressure is generated by a hydraulic pump, Vapor model CF 4225 steam generator water pump, belt-driven by a 2-hp. electric motor. The oil reservoir is in the base of the press and comprises a metal box 18 in. by 23 in. by 11¼ in. made of ¾-in. plate. The top plate of the base is 35¼ in. by 23 in.

Hydraulic press (left) which applies or removes Hyatt roller-bearing outer races in ½ min. The dolly which supports the box is shown with the filler plate for pressing the race in. The complete operation for applying the outer race, including set-up time, requires from 3 to 5 min. The arrangement for removing the outer race is shown at right







Crankshaft Removal Stand

Crankshafts are removed from diesel engines at the Citico shops of the Southern at Chattanooga, Tenn., on a revolving stand that permits positioning the engine at any desired angle. The engine is bolted upright on a pair of longitudinal members of the stand by an overhead crane. The engine is revolved until it is upside down, at which position the bottom halves of the bearing supports are removed and the crankshaft can be lifted clear of the engine by the crane.

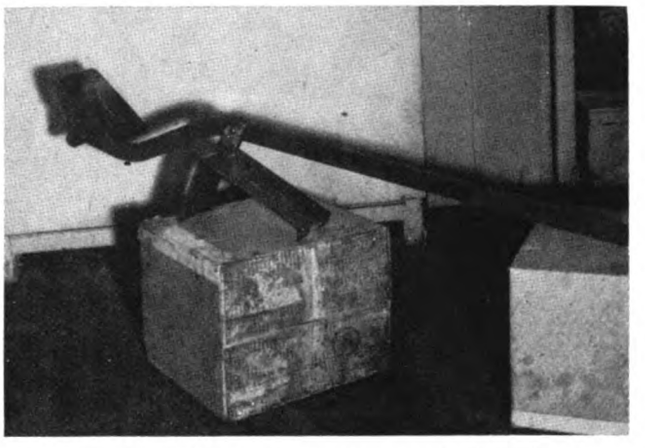
The main vertical supports of the stand are two 40-in. lengths of 6-in. flues. To the top of each vertical support is welded a 12-in. length of a 6-in. flue. The latter flues form the bearings about which the engine is revolved.

The shaft on one end of the stand is integral with a circular plate 1 in. by 27 in. This plate is welded to a second plate which is shaped similar to the end sections of the engine and which is welded to the longitudinal engine supports. The circular plate has eight 1-in. holes 2 in. in from the outside edge of the plate. Pins fit through these holes and through a hole in the upright to lock the stand with the engine in the desired position for removing the crankshaft. The shaft on the opposite end is joined directly to the plate shaped similar to the engine end contour.

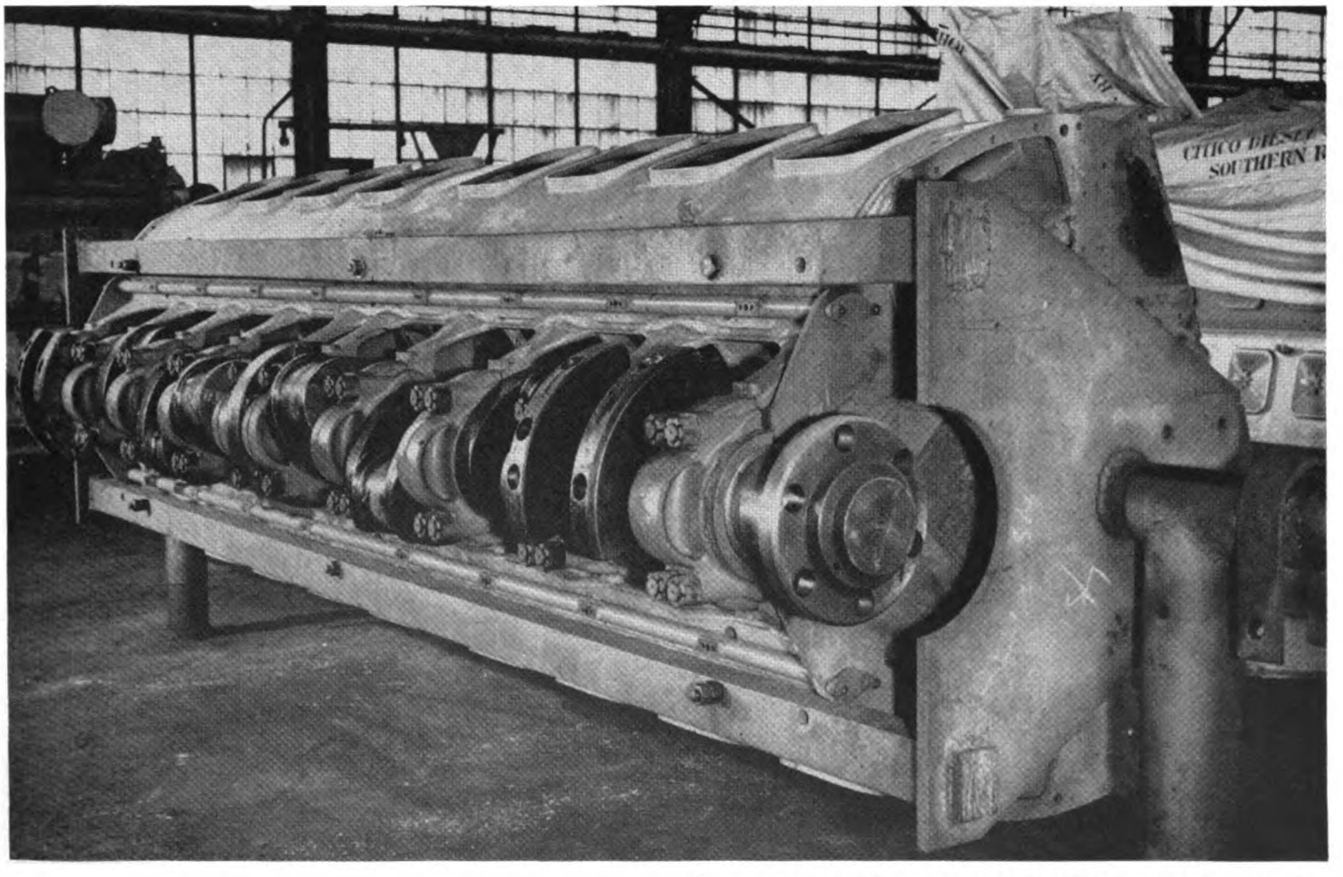
The two supports to which the engine bolts are 3 in. by 4 in. in cross section. Each support has five holes to accommodate the five ¾-in. bolts which secure the engine to the stand. After the engine is securely bolted in place, the stand is revolved by an air motor through reduction gearing.

Permits Inspection of Warm Crank-Shaft Bearings

When a diesel locomotive enters the enginehouse and it is desired to mike the main bearing inserts, no delays are



Leverage arrangement for handling warm bearings when the inserts are to be miked



Stand for applying or removing diesel engine crankshafts

encountered from the bearings being too warm to handle with the bare hand if the leverage device, shown, is employed.

The lifter is in two parts, a small bent fulcrum plate and a long lever with the load end of a concave shape to the approximate contour of the bearing cap. The bent plate rests on the bottom of the inspection opening. The lever contacts the fulcrum plate through a small support pinned to the lever. With the load end of the lever in place under the bearing cap, lowering the free end to tend to raise the cap takes the load off the bolts for easy removal of the nuts. The cap, held in the concave end of the lever, can then be lowered to slip the insert out for miking.

Storage Racks for Top Deck Covers

Diesel locomotive top deck covers are stored neatly and conveniently in an eastern enginehouse on racks located at convenient intervals along the servicing ramp, each rack holding eight covers. The racks rest on a skid made of brake beam backs and can be easily removed from one location to another by fork truck when desired.

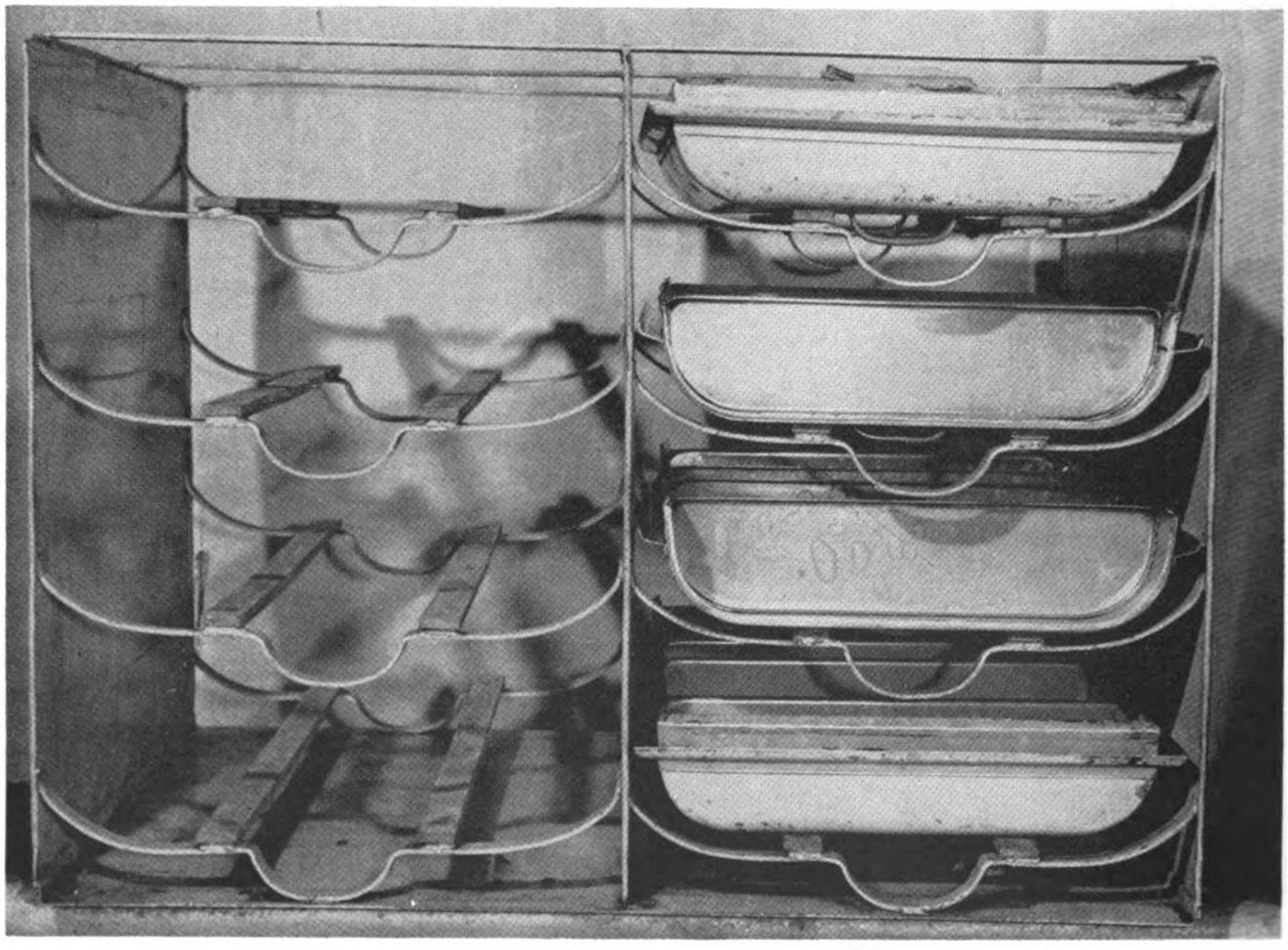
Each rack is 37 in. deep by 44 in. wide by 31 in. high and made of $\frac{1}{8}$-in. steel plate. The covers rest on wood strips $\frac{1}{4}$ in. by $1\frac{1}{2}$ in. which are bolted to strap iron supports $\frac{3}{16}$ in. by $1\frac{1}{4}$ in. The strap iron sections are in general shaped to the contour of the cover and have an arch in the center to accommodate the cover handle. The skid on which the storage rack rests is 43 in. long by 53 in. wide by 14 in. high. The racks are of all welded construction except for the bolts which secure the wood to the strap iron.

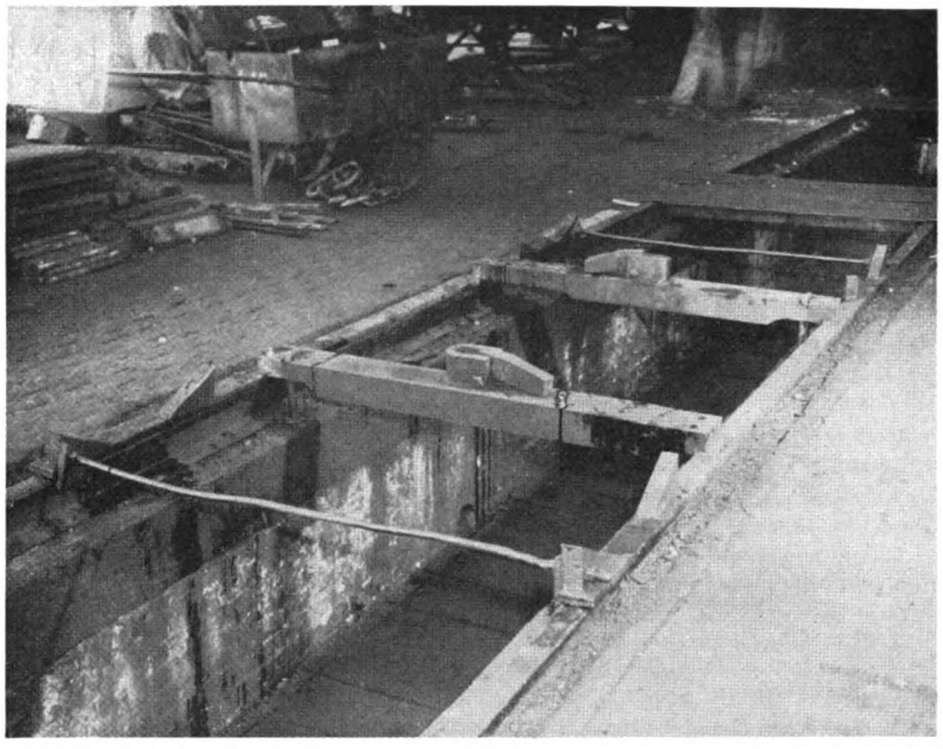
Rack Wheels Diesel Trucks

Personnel at the Southern shop at Spencer, N. C., have built a rack which aids in disassembling, assembling and aligning diesel locomotive trucks. The rack rests on a pair of floor level rails, and the truck is placed on it by a crane with wheels resting between V-blocks welded on the frame of the rack.

The rack consists essentially of two lengths of strap iron 1 in. by 3 in. which rest on the shop rails. The two lengths are held together by two scrap steam locomotive guides welded to the strap iron at intermediate points along the

A top deck cover storage rack mounted on a skid for easy portability





Rack for aligning wheel sets on four-wheel diesel trucks preparatory to assembly

length and by two tie rods that join the ends. The rack is held in proper relationship to the track by small sections of plate near the ends of the tie rods which contact the inside edges of the rails. In the center of each cross bar made from the locomotive guide is a steel bar 11 in. long and with a cross section 1¼ in. by 3 in. Each bar is pivoted about the bottom and swings to a vertical position to support the traction motor when assembling or dismantling the truck.

In dismantling a truck the overhead shop crane is hooked in the traction motor eye and the motor lifted to remove the motor suspension spring. While the motor is held up by the crane the bar is pivoted to a vertical position and the traction motor suspension lug lowered onto the bar to hold the wheel set with the traction motor in the desired position.

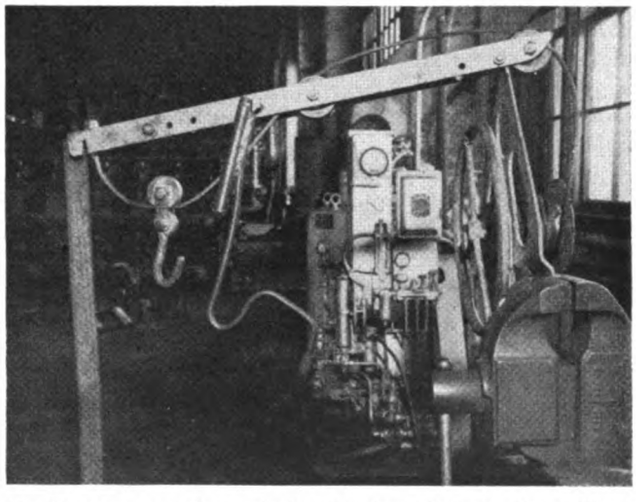
When a truck is to be rebuilt the wheels are set in the pockets formed by the wedges, which automatically realign the truck. The wedges that hold the wheels in place are 1 3/4 in. thick, 4 in. high and 7 in. long. The pairs are properly spaced from each other for aligning and squaring four-wheel trucks.

Derrick for Use Inside Locomotive

The removal of cylinder heads and liners from diesel engines within the locomotive is simplified by the use of a light portable derrick. The derrick consists of a short vertical member and a long horizontal member with a cable and drum mounted on the former, a pair of pulleys and a hook on the latter. The drum used for raising and lowering the liner or head, as the case may be, is equipped with a ratchet to hold the load in any desired position.

The vertical section of the derrick rests on the air baffle. and the end of the horizontal section opposite the vertical section rests on the rail support channel. This puts the horizontal section near the ceiling level and permits raising the cylinder head or liner high enough to swing it clear of the engine.

The shape of the liner lifting attachment is such that the liner can be tilted after raising to swing it clear of the engine for removal. The liner attachment has a length of pipe which fits over one of the liner studs and is secured in place with a nut on the stud. The remainder of the liner lifting attachment fits inside the liner. A short length of rubber hose is affixed to the bottom of this attachment where it touches the liner to prevent scoring.



Derrick for removing cylinder heads and liners from diesel engines within the locomotive propped up on shop floor in position in which it is used. The left end, supported by stick, rests on rail support channel. The right end, clamped in the vise, fits on air baffle. Suspended from horizontal member to the left of center pulley is the attachment for lifting the liner

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

Alarm and Indicator Lights

208-Q.—When does the wheel slip light function? A.—If one pair of wheels slip the white wheel slip light will come on.

209-Q.—What else takes place? A.—The buzzer will sound and generator output is reduced.

210-Q.—Explain this arrangement. A.—Two wheel slip relays are provided per unit, one across the No. 1 and 4 traction motors and one across the No. 2 and 3 motors. When slippage occurs, there is a difference in current between the two fields.

211-Q.—Suppose there is a repeated wheel slippage? A.—The throttle should be partially closed and then gradually re-opened.

212-Q.—What should be done if it is necessary to use sand? A.—Throttle should be reduced, to stop flashing of the wheel slip light before applying sand.

213-Q.—What happens during transition? A.—The wheel slip light will light for an instant during transition from 2 to 3, or 3 to 2.

214-Q.—Is this an indication of wheel slippage? A.—No.

215-Q.—What is the purpose of the Crank Case Exhauster light? A.—This yellow light indicates that the crank case exhauster motor is running.

216-Q.—When does this light come on? A.—When the fuel pump switch on the Engine Control Panel is turned ON.

217-Q.—How long should this light be ON? A.—Continuously whenever the Diesel engine is running.

218-Q.—If the light goes out during operation, what does it indicate? A.—It indicates that either the exhauster motor has stopped or the lamp has burned out.

219-Q.—What is provided on locomotives equipped with Dynamic Brake? A.—A white dynamic braking warning light and relay.

220-Q.—How do these parts function? A.—When the relay closes, the warning light at the engineer's position will light, indicating that the load on the dynamic brake is excessive and should be reduced.

Diesel Engine

Description of Parts
Valve Operating Mechanism

221-Q.—How are the air inlet and exhaust valves operated? A—From two cam shafts mounted on the engine frame.

222-Q.—How are the cam followers constructed? A—They are of the crosshead type with hardened rollers.

223-Q.—What operates the valve levers? A—Push rods in contact with the cam followers operate the valve levers through the valve adjusting screws.

224-Q.—Where are the valve adjusting screws located? A—In the push rod end of the valve levers, the other end of which bear against the equalizing yokes through a ball and socket joint.

225-Q.—How do the equalizing yokes function? A—They operate two air and two exhaust valves per cylinder, each pair of valves being operated from a single cam, push rod and valve lever.

226-Q.—How about the opening of the valves? A—As the equalizing yoke slides up and down on a guide rod, both valves open the same amount.

227-Q.—What provision is made for differences in valve stem lengths? A—An adjustment is provided to compensate for difference in valve stem lengths or depths of seat from regrinding valves.

228-Q.—From where is lubrication of the valve lever mechanism provided? A—From a lube oil header along each bank of cylinders.

229-Q.—How is the assembly lubricated? A—Individual lines conduct the oil to the valve lever shaft and then to the valve lever bushings. Drilled holes through the valve levers lead from the bushings to the equalizer yoke ball joint. Excess oil from this ball joint lubricates the yoke guides and the valve stems. Another drilled hole conducts the oil to the ball end adjusting at the opposite end of the valve lever.

230-Q.—What becomes of the excess oil? A—All excess oil flows down the push rod, lubricating the cams and cam followers.

Cylinder Heads and Valves

231-Q.—What type cylinder heads are used? A—Individual high strength cast iron cylinder heads are used on each cylinder.

232-Q.—How are the heads secured? A—To the engine frame by seven studs.

233-Q.—What valves are in the cylinder heads? A—Four identical valves are in the cylinder head: two exhaust and two air.

Steam Locomotive Boilers

By George M. Davies

Injector Steam Consumption

Q.—How does the steam consumption of an injector compare with that required by a boiler feedwater pump used in conjunction with the feed water heater equipmnt? —F.E.D.

A.—The amount of steam used by injectors for boiler feeding is a fairly constant quantity for a given size in-

* This series of questions and answers relates specifically to the Alco-G.E. diesel-electric locomotives.

jector, and will vary from 3,500 to 5,000 lbs. per hr. All of the heat in the steam above that required for actually pumping water into the boiler against boiler pressure is returned to the boiler as heat in the feed water. The efficiency of the injector as a pump alone is not over two per cent, so that the net steam charged to the injector is negligible.

The quantity of steam used by boiler feed pumps varies from two to five per cent of total steam generated. The exhaust from the boiler feed pump is usually returned to the feedwater heater with a consequent recovery of a part of the heat in the pump exhaust. This will reduce the quantity of steam actually used by the boiler feed pump to a relatively small amount.

Effects of Water In the Dry Pipe

Q.—What are the effects of water carry over into the dry pipe of a locomotive boiler?—R.E.L.

A.—Water carry over into the dry pipe of a locomotive boiler directly affects the superheater. Moisture in the steam must be evaporated in the superheater and for each 1 per cent of moisture entering the superheater there is a decrease in superheat of approximately 15 deg. F. Also the scale deposits in the water carry over accumulates in the superheater units retarding the steamflow and velocity through the units resulting in superheater unit failures.

Reinforcement Requirements

Q.—Our specification for all-welded shells requires that longitudinal, circumferential and other joints uniting the plates of the boiler shell or other parts shall be of the double-welded butt type and shall be reinforced at the center of the weld on each side of the plate by at least 1/16 inch up to and including 5/8 inch plate and up to 1/8 inch for heavier plates. Is this reinforcement required in order to maintain the efficiency of the seam?—M.R.V.

A.—The A.S.M.E. Power Boiler Code provides that all longitudinal, circumferential and other joints uniting the plates of the drum, shell, or other pressure parts, shall be of the double-welded butt type and shall be reinforced at the center of the weld on each side of the plate by at least 1/16 inch up to and including 5/8-inch plate, and up to 1/8 inch for heavier plates. The allowable efficiency of such seams, provided the welding meets all test requirements, is 95 per cent provided all weld reinforcement is removed substantially flush with the surface of the plate, machined off, otherwise a joint efficiency not to exceed 90 per cent shall be used.

Schedule 24 RL Air Brakes

Automatic Train Control

1125-Q.—How may this brake application be forestalled? A.—It may be forestalled by the engineman if an acknowledging device is operated before passing the wayside signal.

1126-Q.—What essential apparatus is used with the Speed Cotnrol systems? A.—(1) Service brake application valve; (2) Timing valve; (3) A-1 Suppression valve; (4) Single pointer air gage; (5) Duplex air gage; (6) Cut-out cock; (7) Second reduction reservoir; (8) Suppression reservoir and (9) Suppression timing reservoir.

1127-Q.—What essential apparatus is used with the Continuous Automatic Stop System? A.—Items 1, 2, 4, 6 and 7 above and Stop Reservoir.

1128-Q.—What apparatus is used with the Cab Signal System with whstle and acknowledger? A. — Whistle magnet and bracket assembly or NM-1 reducing valve and magnet assembly.

1129-Q.—What essential apparatus is used with the Intermittent Automatic Stop System? A—(1) Magnet and bracket; (2 Acknowledging valve; (3) Reset cock; (4) Cut-Out cock; (5) Acknowledging Reservoir and (6) Second reduction reservoir.

Train Control Operation

1130-Q.—From where is the train control system charged? A.—The train control system is charged by main reservoir air from the brake valve and by air at reduced pressure from the NS-1 reducing valve.

1131-Q.—What does the reducing valve consist of? A. —A pipe bracket *2*, in which are mounted check valve portion housed in body *11*, the cut-out cock portion housed in body *53* and the reducing valve portion housed in body *18*.

1132-Q.—How does the check valve portion function? A.—It permits reducing valve air to flow to the system but prevents any back flow.

1133-Q.—How does the cut-out portion function? A.— It provides means of cutting off the air supply to the system.

1134-Q.—How does the reducing valve portion function? A.—Reduces the supply air to a predetermined amount.

1135-Q.—Explain the operation of the reducing valve when charging. A.—Main reservoir air enters the valve through passage *s* and flows to supply chamber *C*. Spring *47* has moved diaphragm follower *41*, exhaust valve seat *39* and the exhaust and inlet valves upward.

1136-Q.—What then happens? A.—This unseats the inlet valve and supply air from chamber *C* flows past inlet valve seat *31* into chamber *B* and passage *r* to the system and to the check valve *12*.

1137-Q.—What other flow of air occurs? A. — The air also flows through choke *D* to chamber *A* on top of diaphragm *40*.

1138-Q.—What happens when air pressure in the system and chamber A reaches the amount for which the adjusting screw 45 is set? A.—The air pressure and spring *38* move diaphragm *40*, follower *41* and exhaust valve seat *39* downward. Inlet valve spring *34* moves inlet valve down on its seat *31*, cutting off further flow of air.

1139-Q.—What action takes place if the pipe to the timing valve ad chambers B and A are charged to pressure in excess of the setting of adjusting screw 45? A. — In this case, air pressure and spring *38* move diaphragm *40* and exhaust valve seat downward so that the exhaust valve is unseated.

1140-Q.—What is the result of this movement? A. — The overcharge of air from chambers *B* and *A* is permitted to flow past unseated exhaust valve seat *39* into the spring housing *43* and through the exhaust port to atmosphere. As the setting of the adjusting screw is reached in chamber *A*, spring *47* moves diaphragm follower *41* and exhaust valve seat *39* to seat the exhaust valve, preventing further flow of air.

ELECTRICAL SECTION

Load Testing Axle Generators

Variable-speed drive for load-testing 1½- to 15-kw. generators developed in Los Angeles General Shops of the Southern Pacific

*By J. C. Alvarez and Fred Lewis**

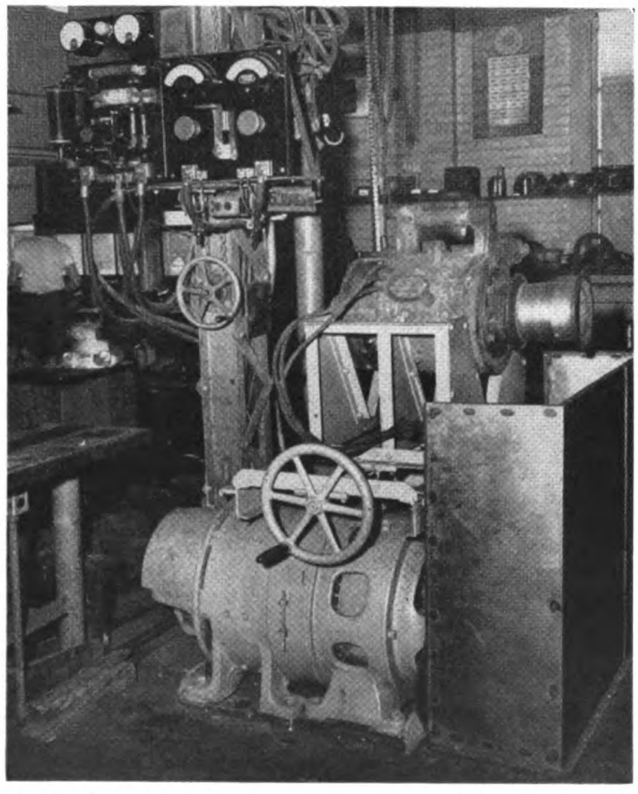
THE LOAD tester shown in the illustrations was built in response to a need for testing axle generators in the shop under road operating conditions. It was constructed by the authors using material on hand under the supervision of A. E. Lines, departmental foreman of electricians.

The tester provides for driving the 1½- to 15-kw. generators under load at all of the speeds encountered in service. It consists basically of a motor generator set which supplies power to a variable-speed motor which is used to drive the generators under test. A belt drive is used for the smaller generators (which are belt-driven in service) and direct drive is used for generators ranging in size from 7½ to 15 kw.

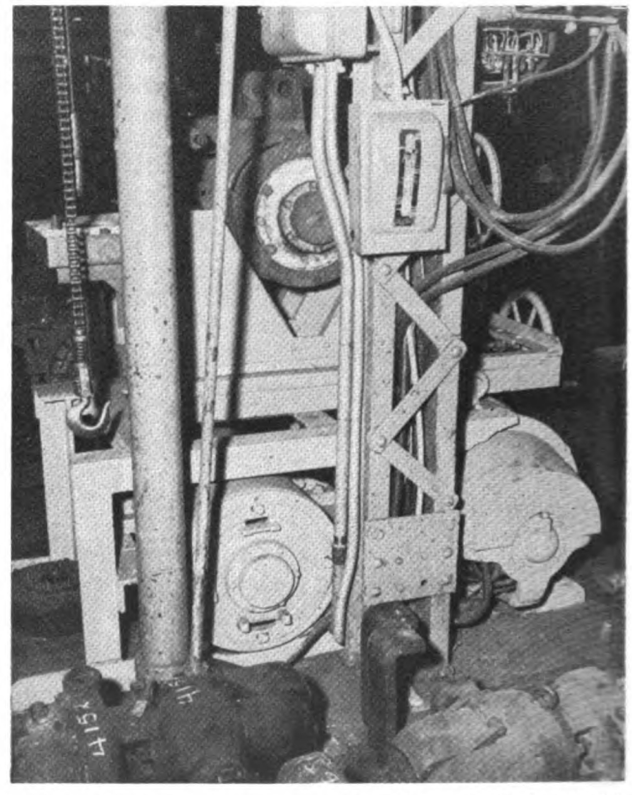
The motor-generator set is an old electric welder which consists of a 440-volt, three-phase, a.c. motor driving a generator rated 300 amp. at 50 volts. Its voltage is controlled by a rheostat as shown in the diagram.

The variable-speed motor, driven by the generator, is separately excited as shown in the diagram. It is fitted

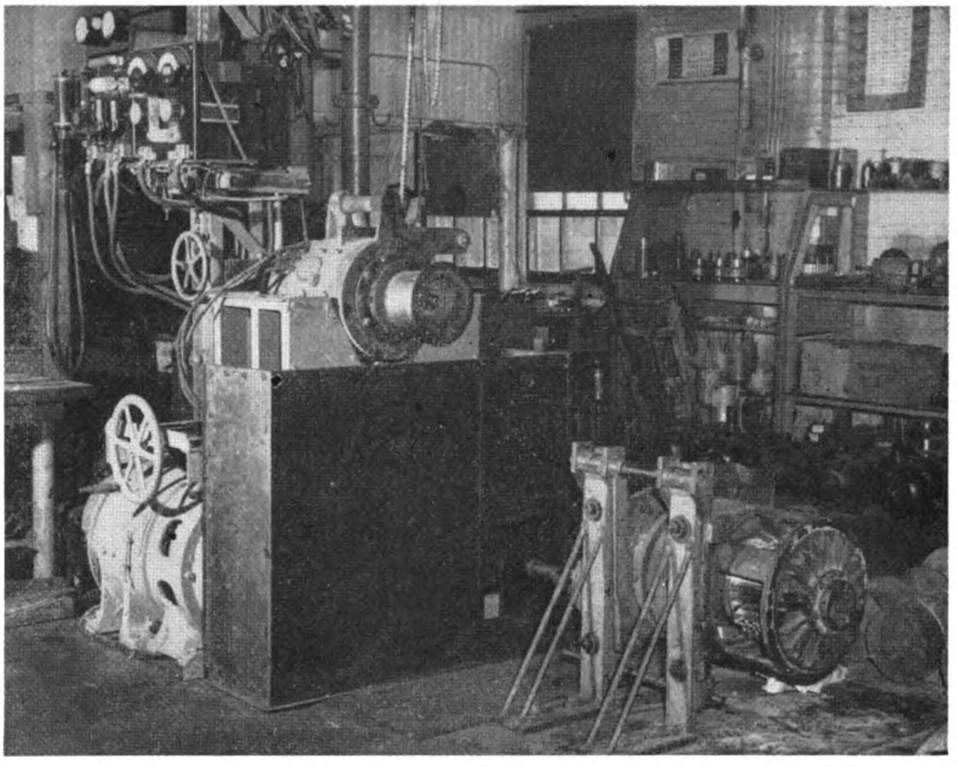
* Electricians, Los Angeles General Shops, Southern Pacific Company, Los Angeles, Cal.



Front of the drive showing the m.g. set in front and a small axle generator in the V-mount. The motor control panel with motor and generator rheostats is on the column. The axle generator control panel is on the bracket at the left



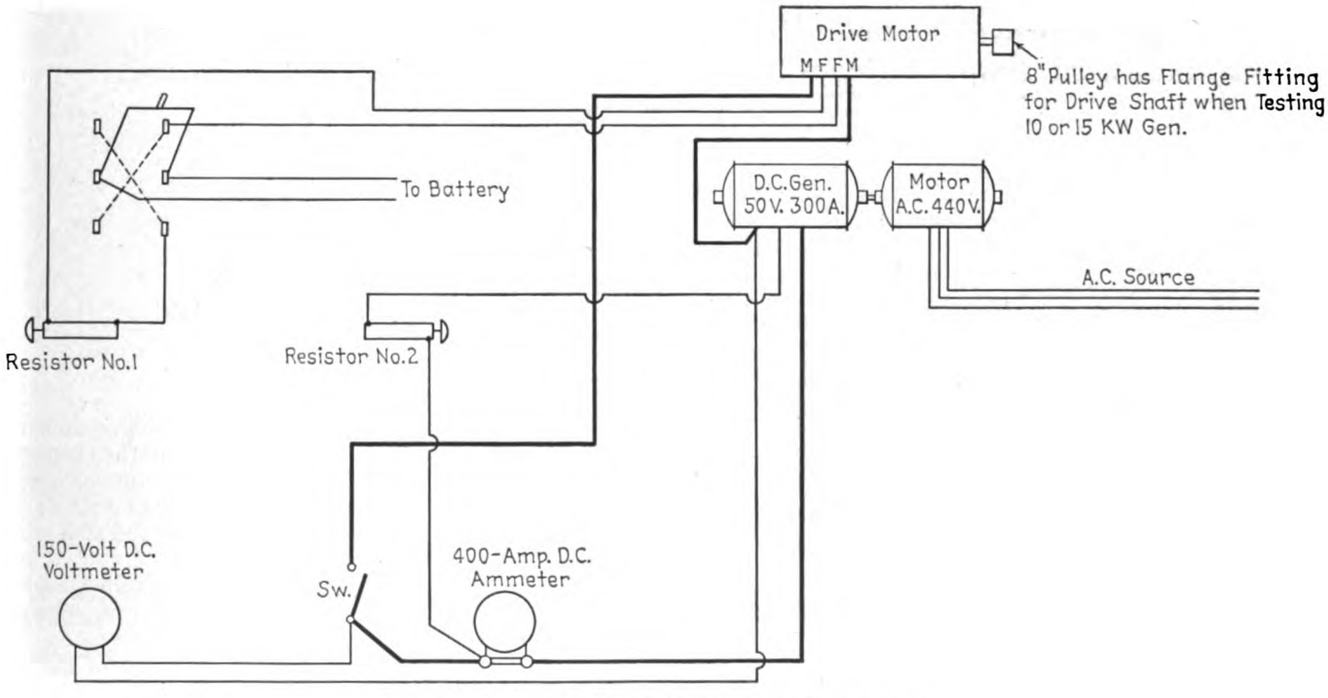
Back of the drive showing a small axle generator in the V-mount, the variable-speed motor, lower left, and the m.g. set, lower right. Tre chain hoist is used for placing the generators under test



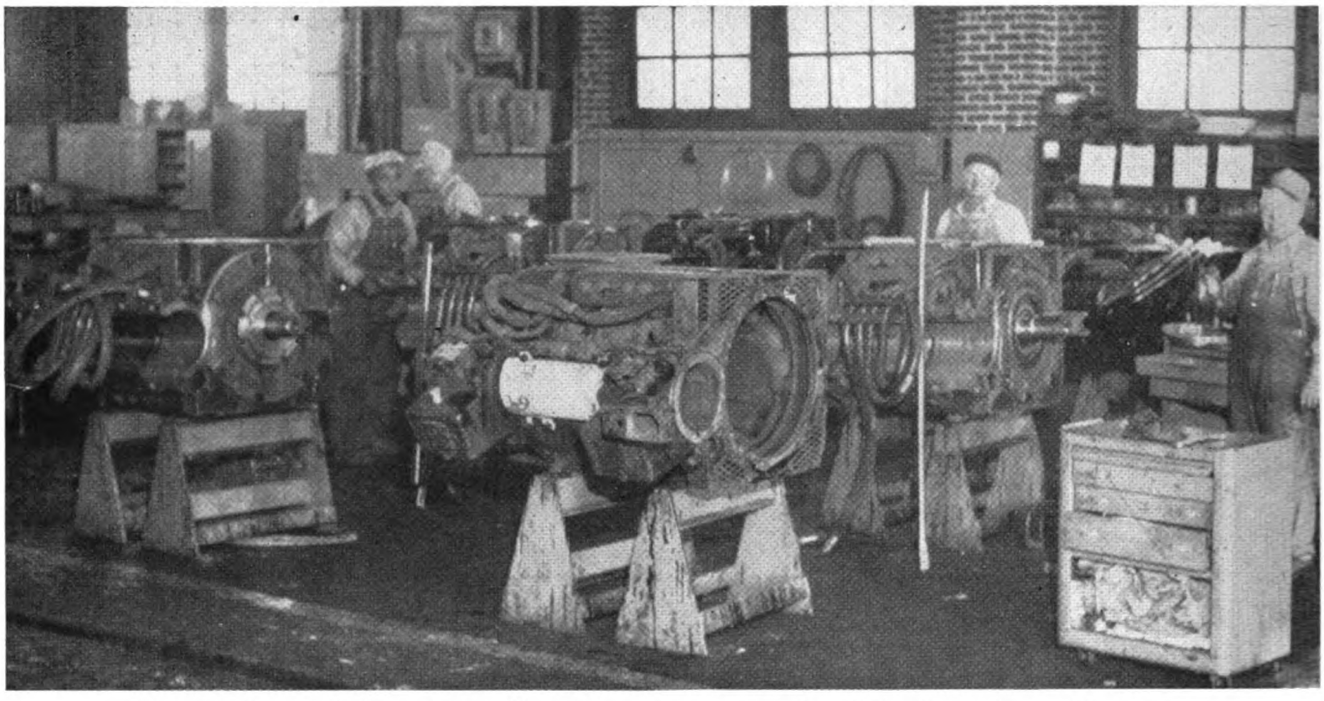
Front of the drive, showing the m.g. set, lower left, a small axle generator (not bolted) in the V mount, and at the lower right a large axle generator directly connected to the variable-speed motor behind the belt guard

with an 8-in. pulley which is used for a flat-belt drive to the smaller generators which are placed in the V support shown at the top in the large photograph. This V mounting is on a carriage which can be moved back and forth by means of the handwheel shown at the left. After a belt is applied, the handwheel is used to obtain the required belt tension. In the same illustration, the motor-generator set is shown, lower left, and at the lower right is a large generator under test which is directly connected to the flange fitting on the end of the 8-in. pulley on the variable-speed motor.

Generators under test may be driven at speeds ranging from 200 to 2,200 r.p.m. The test is made at 40 volts, and the current range is 200 to 325 amp. Generators under test are loaded on an Allen Bradley grid resistor bank.



Wiring diagram of drive for load testing axle generators



Motors undergoing light run tests. Five motors are processed through the shop and tested in a group.

Operation of the Southern's Electrical Repair Shop

Many improved methods, including batch-handling of motors, have increased shop efficiency and insured long service on the road

*By R. H. Herman**

THE article in the May issue of *Railway Mechanical and Electrical Engineer* discussed in detail the layout of machinery and equipment in the Southern's traction motor and generator repair shop at Atlanta, Ga. While the ultimate layout will not be completed for some time, the operating procedures have been well established and no difficulty should be experienced in future expansion of these facilities to take care of full requirements.

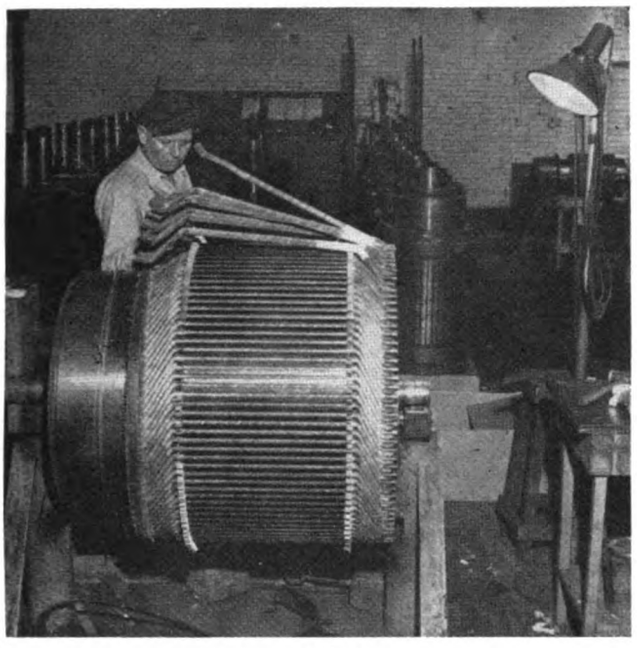
Traction motors, main generators, auxiliary generators and small motors are shipped to and from Atlanta in box cars, gondolas or flat cars. It is extremely important that this equipment be loaded and protected in such a manner as to eliminate damage due to rough handling. Special flat cars are now being used for shipment of traction motors. These cars are fitted with structural steel cradles bolted to the floor, with braces and rods to hold the motor securely, preferably with the axis of the shaft parallel with the car axles. This eliminates any possibility of damage to bearings or brackets if the car receives a severe bump which would shift the armature laterally in the frame.

* Engineer, Shops and Equipment, Southern Railway System, Washington, D. C.

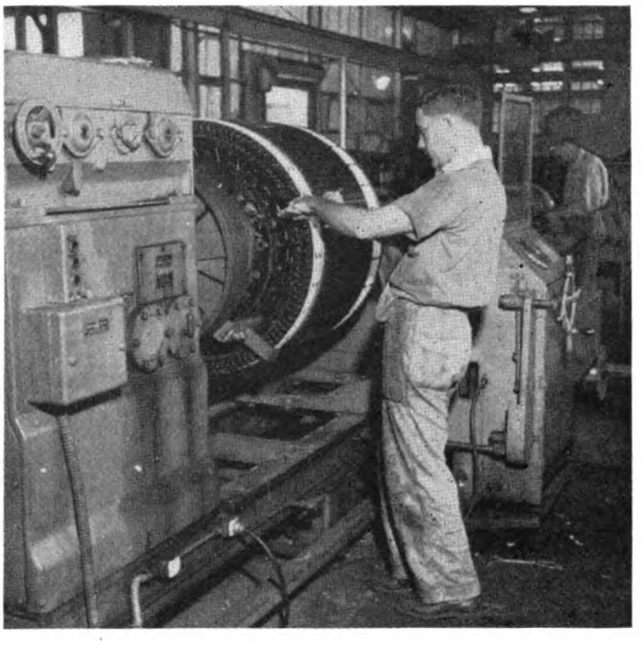
Dismantling and Inspection

Upon the arrival of the car at Atlanta, the equipment is unloaded from the car by an outside overhead crane and placed on trailers or floats. Gasoline tractors are used to pull the trailers from the storehouse to the repair shop, where they are unloaded in the dismantling and stripping area, adjacent to the vapor degreaser.

Traction motors are received in the shop with the pinions in place on the shaft, since it is not the practice of the Southern to match pinions and gears. The first operation is removal of pinions, with the exception of the 12 tooth pinions which are integral with the shaft. Induction pinion heater coils purchased from National Electric



Rewinding a main generator armature

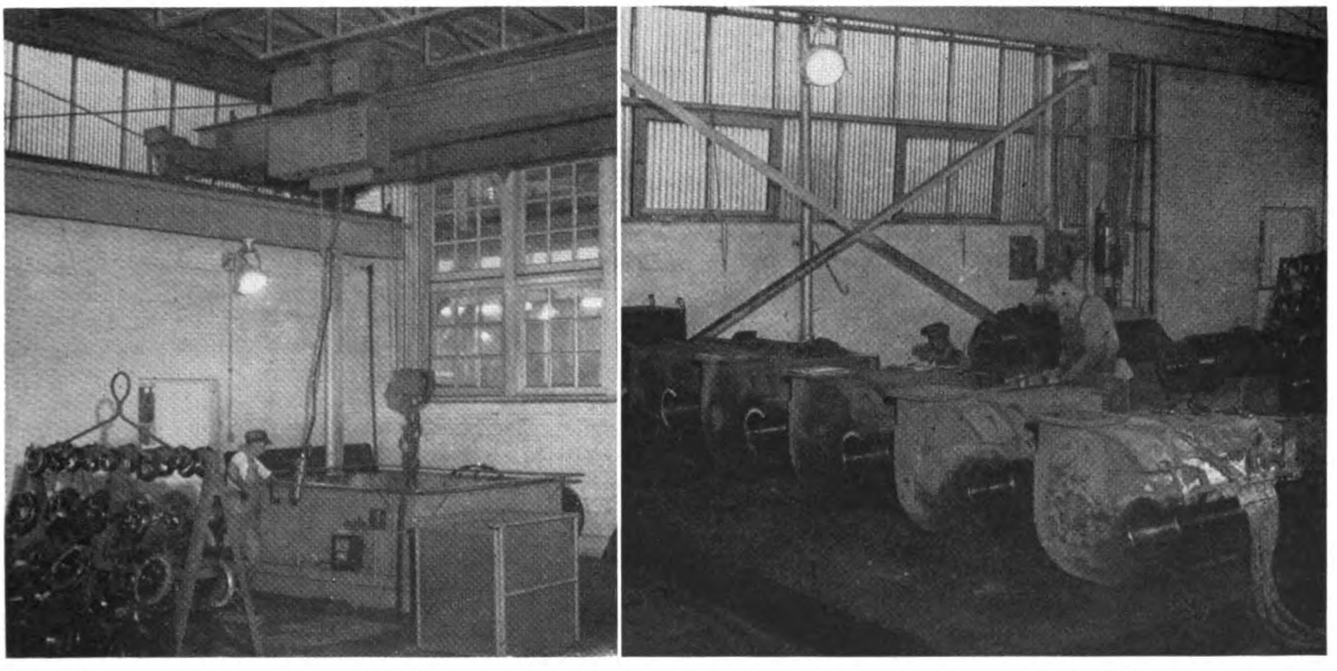


Applying band to generator armature

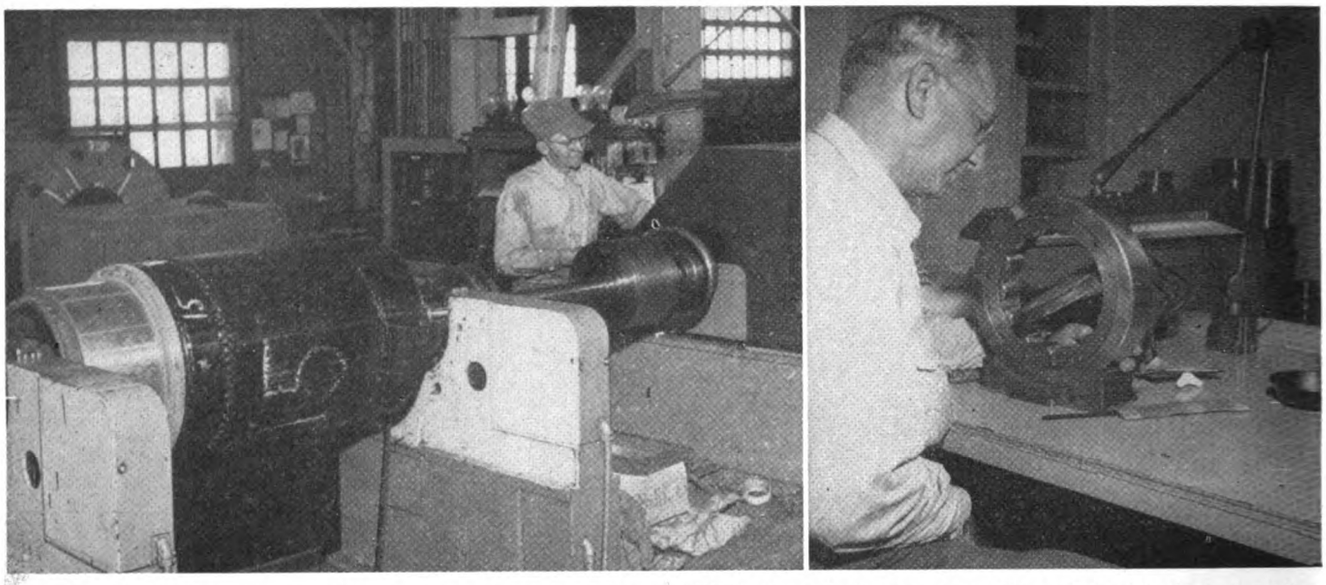
Coal Company are used to heat the pinion, after which it is removed by wedges, supplemented when necessary by a Rodgers hydraulic pinion puller. Coils of different sizes are provided to suit the full range of pinion outside diameters.

After removal, the pinions are carefully checked for cracks or defects by visual and Magnaglo inspection. The pinion is slipped over a copper bar and current from the power unit passed through the bar to magnetize the pinion. A solution of Magnaglo paste in a light oil is brushed over the pinion after which it is inspected for defects under black (ultraviolet) light. The entire operation is performed in a curtained enclosure. This arrangement has proven very satisfactory for locating cracks or defects at any location on the pinion, although particular attention is given to the area at the root of the teeth. After dimensional checks, the pinion is stored until it is reapplied to a motor.

In the meantime, the foreman in charge makes a careful inspection of the motor before and during dismantling and fills in information on a form titled "Motor Inspection on Arrival." If the shipping point has reported the



Left: Vapor degreaser is served by the 10-ton overhead traveling crane. Note the special angle-iron racks with hooks and brackets to support bearing caps, bearings and miscellaneous parts. The entire rack is lifted by the crane and lowered into the degreaser tank. Right: Dismantling and stripping area. Five motors are dismantled at one time



Left: Traction motor and generator armatures are balanced in a Gisholt Dynetric balancing machine. Right: Bearing assemblies are inspected for defects by means of an eight-power magnifying glass.

motor removed from service due to defect or failure, the form is stamped "Failure—Inspect for Cause" and the foreman examines the motor in an effort to determine the cause of failure. At the same time, the mechanic fills out a detailed form covering condition, dimensions of critical parts, etc., and a job number is assigned to cover both the armature and the frame.

Five Motors at a Time

An interesting feature of the operation is the practice of processing five traction motors through the shop at a time. Five motors are set on stands, approximately 12 in. high, and stripped simultaneously, while five armatures and five frames are progressed through the degreaser, bake ovens, vacuum impregnator, etc., up to final assembly. This arrangement permits full use of the various items of equipment and has reduced labor costs for handling.



Brushholders are inspected and overhauled at a special bench. They are then stored in a cabinet with glass fronted doors

The motor is completely dismantled in the area adjacent to the degreaser. Axle bearing caps, axle shield, housings, bearing assemblies, oil throwers, brushes, brush holders and other parts and removed and transferred to work benches where they are checked for dimensional tolerance and reconditioned for further service.

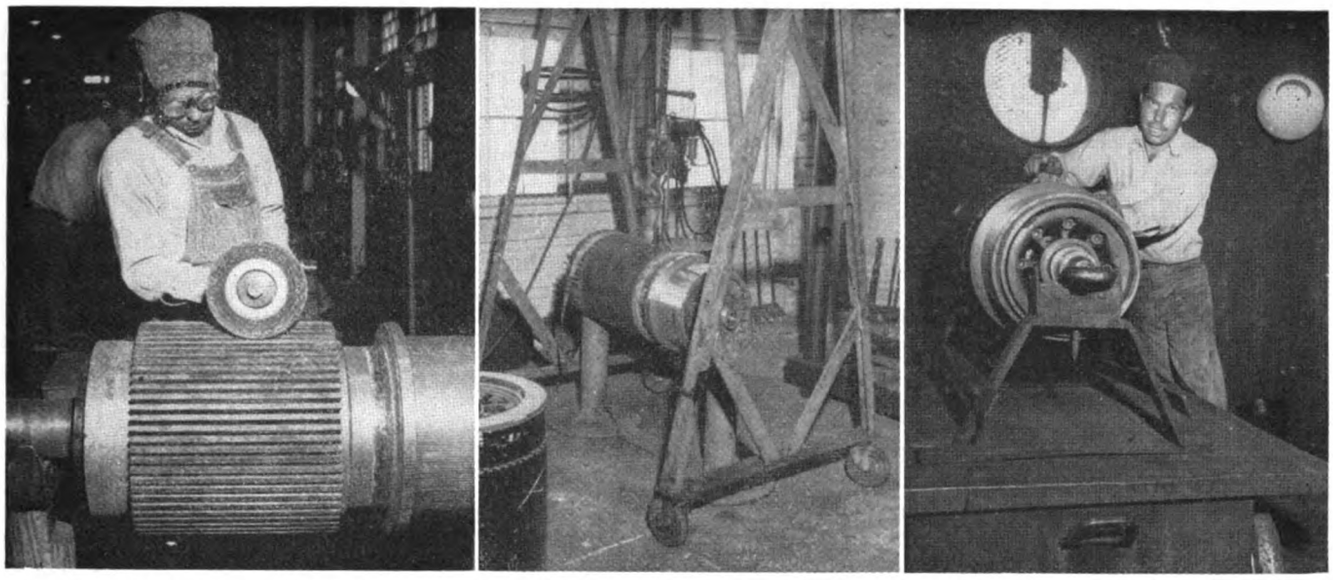
Bearing assemblies are cleaned in the degreaser, after which they are passed into the bearing overhaul room. They are dipped into tanks of mineral spirits and blown off with compressed air. This procedure leaves a thin film of oil which provides protection against corrosion. The bearing is carefully inspected by means of an eight-power magnifying glass for any indications of pitting, shellout, flat spots on rollers, burns of any nature, loose rivets on the retainer cage or any fissure or cracks. If there is any doubt as to condition, the bearing is condemned and returned to the manufacturer for reconditioning. Defective inner races are replaced, but a defect in rollers or cage will condemn the entire bearing. If the bearing is found to be satisfactory, it is given a coating of No. 10 oil and stored for further service.

Frame Overhaul

Traction motor frames are carefully inspected for loose or chafed field or interpole coils, indications of thrown solder and condition of insulation on coils and connections. No electrical tests are made before cleaning, and after inspection, the frame is placed in the degreaser for a period of approximately 20 minutes. It has been found that the degreasing process will clear up partial grounds or other conditions which would show low resistance readings if tests were made upon arrival of the motor in the shop.

It is necessary to remove dust, paint and scale, after the frame is lifted from the degreaser tank. This is now done by hand with wire brushes and then blowing with compressed air. A soft abrasive blast outfit is on order and when installed will permit the operation to be performed in a more efficient and economical manner.

It is the practice at Atlanta to carefully inspect the



Left: Slots in armature core are thoroughly cleaned with a motor-driven wire brush before rewinding. Center: Stripping coils, wedges and insulation from an armature core using a 1-ton electric hoist on an A-frame and a come-along to grip the coil. Right: Interior of cleaning and paint spray booth

motor leads on the outside of the frame on all motors going through the shop. The cable blocks are removed, tape and twine removed, and the cables are separated and turned back to permit thorough inspection at the locations where the cable enters the frame through the grommets or rubber bushings. If no defects are found, the cables are secured with heavy twine, retaped, painted and entrance locations sealed with asphalt compound. The care taken in this operation is reflected in the fact that no grounds have devloped on the motor leads on any motors turned out of the shop.

The brushholders are re-installed, and the frame is given resistance and high potential tests, after which it is ready for assembly.

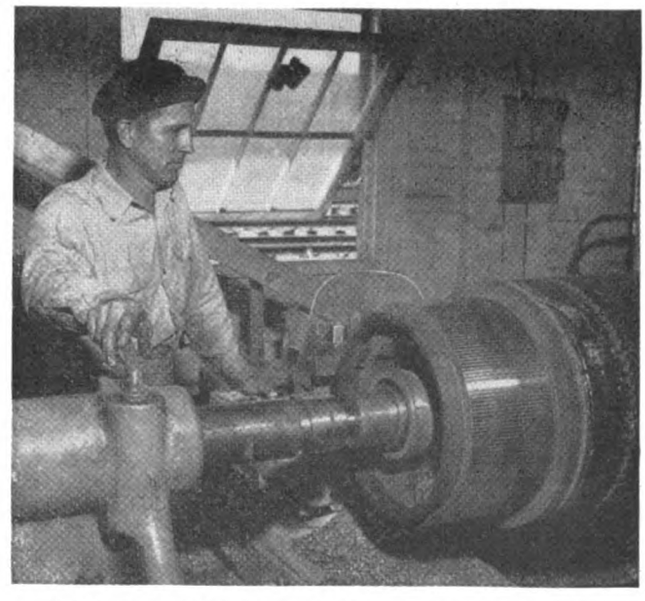
Frames which require reboring of suspension bearing housings or other machine work are returned to the manufacturer for attention. However, minor work such as building up worn nose supports, etc., is performed at Atlanta.

Armature Overhaul

The armature is carefully inspected after disassembly of the motor for loose wire bands, loose coils or wedges, condition of string bands and for signs of any unusual condition such as indications of overheating, etc. It is then placed in the degreaser for a period of approximately 15 minutes. Dust and loose scale are removed by wire brushes and blowing with compressed air. Hypot and resistance tests are then made, and if the armature is found to be satisfactory, it is moved to the vacuum impregnator and held under 30 in. of vacuum for approximately 30 min. Varnish is allowed to flow from the storage tank into the impregnating tank and when the proper level is reached, the valve is closed and carbon dioxide gas is used to apply a pressure of 30 p.s.i. for a period of 30 min. This insures penetration of the varnish into any cracks or crevices in the insulation and tightens armature coils and slot wedges. The varnish is forced back into the storage tank and a final vacuum maintained for a few minutes to evaporate the solvent. After impregnating the armature is placed in an electrically-heated, forced- circulation bake oven where is is baked at a temperature of 150 deg. C. for a period of 20 hr.

An engine lathe is used for turning the commutator, using a tool post grinder for final finish. It is proposed to provide a commutator seasoning stand for checking and grinding commutators as well as seasoning them when necessary. String bands, risers and V-ring are inspected, cleaned and painted with several coats of red insulating varnish to secure a smooth surface and eliminate any possibility of flashovers.

The armature is placed in a Gisholt Dynetric balancing machine and carefully balanced to a high degree of accuracy, after which it is sprayed with a coat of air drying varnish. A bar to bar test is made on the commutator. Both ends of the armature shaft are Magnaflux tested and the armature is ready for assembly with the frame.



Armature coil ends are cut in a lathe prior to stripping

Assembly of Traction Motor

Assembly work is started by applying the bearing caps on both ends of the shaft and, after preheating the oil thrower and inner race, shrinking them in proper position on the shaft. The outer bearing races, rollers, gaskets and covers are then applied to complete the armature sub-assembly.

With the frame on a stand in a vertical position, the armature is lowered into place and the pinion-end housing pulled down by means of cap screws. The motor is then turned to a horizontal position, and both bearing housings are drawn into place. The bearing cap is removed again from the commutator end, and dial indicator checks of runout of inner race face, internal bearing clearance, etc., are made and recorded. Assembly of bearing covers, bearing retainers, oil rings, etc., are completed, after which the pinion end bearing cover is removed and further clearance checks made and recorded.

The terminals of the motor are connected to a motor generator set, which supplies d.c. energy at 70 volts. It is then run light for a period of approximately eight hr. and checked at frequent intervals for bearing noises, temperature rise or any other unusual conditions. If the motor is found satisfactory, the pinion is heated in an induction heater and applied to the shaft, after which the motor is ready for shipment.

Armature Rewinding

Armatures which fail in service or are found to be defective must be rewound and facilities and equipment are included in the traction motor shop for performing this work. In order that it may be done in an economical manner it is necessary to provide the shop with a number of additional machines which would not be required for basic or mileage overhaul work only.

The procedure followed is generally in accord with the manufacturer's detailed maintenance instructions, supplemented by recommendations of armature coil manufacturers. There are, however, certain practices which have been developed at Atlanta which should be of interest to representatives of other railroads, operating a rewinding shop or contemplating the construction of such a shop.

The vapor degreaser used for cleaning armatures and frames in the shop for basic overhaul, has proven to be a valuable time saver when stripping coils, wedges and insulation from armatures to be rewound. The armature is placed in the degreaser for approximately 45 min. to remove or soften the varnish on coils and core, after which it is placed in an engine lathe. A special lathe tool is used to cut through both the top and bottom coils at a point adjacent to the commutator neck and at the end of the core on the pinion end. Care is taken not to damage the insulation under the coils and cutting is continued only as long as copper turnings are observed. The armature is placed on a special stand where the oil ring, wire bands, etc., are removed, after which the coils are pulled from the slots, one at a time, using a come-along grip and a one-ton electric hoist on a jib crane. This arrangement has proven to be very satisfactory in the stripping operation.

After removal of coils, insulation, etc., the fillers and coil ends in the commutator neck are removed by heating and knocking them out with a mallet and drift.

A portable infra-red oven has been developed in the shop for heating the commutator when driving out the coil ends and fillers. The oven consists of 25 infra-red lamps arranged to form two complete circles in an enclosing case. The housing has an inside diameter of 19 in. to permit it to be placed over the commutator and the surface of the commutator, except for the risers, is covered by heavy asbestos tape or cloth during the time the oven is in place. Approximately two hours heating is required before the solder has softened enough to allow coil ends and fillers to be removed with a drift tool. The principal advantage of this arrangement is that the risers are left well tinned and it is only necessary to dress them lightly with a file.

The armature core, slots, coil supports, etc., are then thoroughly cleaned of varnish, old insulation, dirt, cement, carbon dust and copper shavings. A mixture of shellac and alcohol is applied to the entire surface to protect the armature from rust or corrosion during rewinding operations.

Specially Designed Roll Type Banding Machine

A specially designed roll type banding machine is used for applying temporary bands over the equalizers as well as over the entire armature after installation of top and bottom coils. This machine was purchased from the Electric Service Manufacturing Company, and is capable of banding armatures up to 48 in. in diameter, and up to 72 in. in length. The roll method of banding is used with the tension on the band wire maintained by a compressed air cylinder. It is possible to apply as high as 1,000 lb. tension to the wire with 100 p.s.i. air pressure. In addition to temporary bands, the lathe can also be used to apply permanent bands.

Temporary bands are re-rolled four times with the air cylinder applying a tension of 450 lb. to the band wire. The same tension is used in rerolling the bottom permanent bands. However, the top permanent bands are applied using only a tension device to maintain 400 lb.

A preheating device for armature coils has been developed in eliminating damage to the coils when they are installed in the slots. A battery of infra-red lights consisting of 13 rows of 4 lamps each, in a sheet metal asbestos insulated housing is supported approximately 2 ft. above a steel table. The coils are placed under the lamps for a short period to preheat them before they are placed in the slots.

Coil ends are brazed on an American Electric Fusion Corporation electric brazing machine designed specifically for traction motor and generator armatures. It consists of a lathe type stand to support the armature on centers, water cooled brazing heads supported in proper position with integral brazing transformer and control. Installation of this unit reduced the time and labor required as compared to previous hand tong brazing. Furthermore, more uniform results are secured.

This is the second of three articles by Mr. Herman on electrical repair work at the Southern's Pegram (Atlanta, Ga.) Shops. The third, and final installment, dealing with the records kept relating to repairs, and miscellaneous repair operations, will appear in a subsequent issue.

* * *

Correction Notice

In the Consulting Department of the April 1951 issue, under Car Electrical Equipment Questions and Answers, the first line of the fourth paragraph of the answer was omitted. The first sentence of the paragraph should read: "The use of a generator regulator with a bias coil makes it possible for a railroad to select a genemotor having an a.c. motor of the proper capacity."

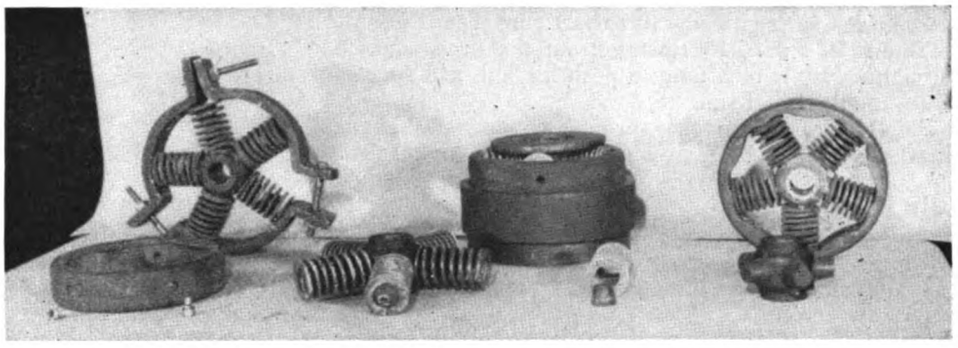


Fig. 1—Parts and assemblies of spring wheels and jigs for removing and applying springs

Replacing Springs on Roll-Out Carriage Wheels

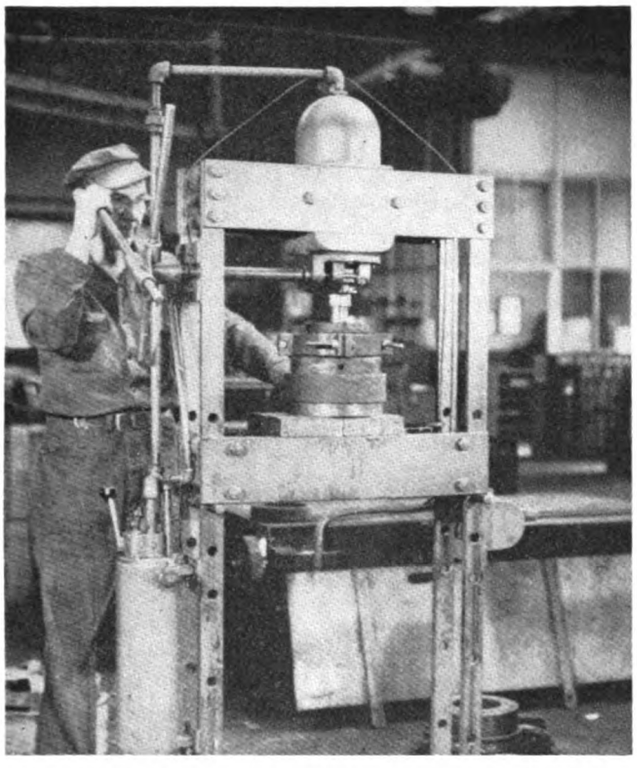


Fig. 2—The hand press used to remove and apply springs

WAUKESHA Ice Engine units for passenger-car air conditioning are mounted under the car on roll-out carriages to facilitate inspection and replacement. The four spring rollers on which the units are supported are wheels each having five coil springs which function as spokes.

It is necessary at times to replace broken springs. A method for doing this has been developed in the Paducah, Ky., shops of the Illinois Central, which makes this difficult job easy, and which completely avoids injury to the operator which might be caused by a flying spring.

The springs are held in place by five cork-shaped rubber plugs secured to the hub, and five secured to the rim of the wheel. These rubber inserts fit the inner diameter of the springs. The rubber plugs have threaded metal inserts by means of which they are secured. When they are all in place, the plugs in the rim of the wheel are fastened in place by means of cap screws inserted through the holes in the rim, and screwed into the metal inserts in the rubber.

Parts and assemblies of the wheels and jigs for removing and applying springs are shown in Fig. 1. The hand press on which the work is done is shown in Fig. 2.

To remove a set of springs, the set screws in the rim of the wheel which hold the outer five rubber plugs are removed. Then the wheel is placed on a jig on the bed of the press as shown in Fig. 3. The jig is recessed to allow the wheel to rest on a shoulder inside the jig ring or cylinder. A disk, slightly smaller than the inside diameter of the rim, is placed over the hub and springs. Pressure from the press spindle then pushes the hub and springs into the inside of the jig cylinder where they cannot fly and where they lie as loose parts free of tension or compression.

To insert springs in a wheel, the five springs are fitted over the five rubber plugs on the hub and secured by a three-part ring which is shown at the left in Fig. 1. When the three bolts in this ring are drawn up, the springs are compressed slightly more than they are when in the wheel. A wheel rim is then placed into the recess of the jig, and

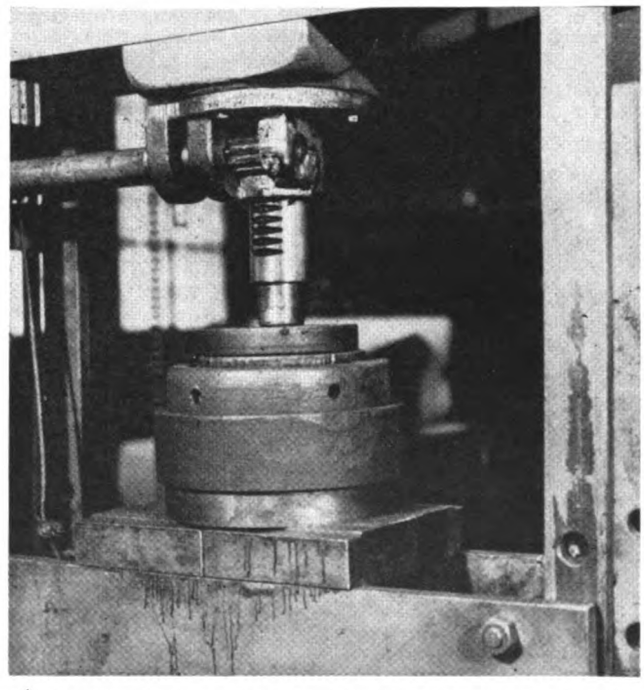


Fig. 3—A set of springs is being pushed of a wheel rim into the jig at the bottom

the hub and springs in the three-part ring placed over it as shown in Fig. 4. Pressure from the press applied through a disk is then used to push the hub and springs down into the wheel rim.

Final alignment of the springs is accomplished as shown in Fig. 5. A piece of shafting is pushed through the hole in the hub and supported on the press bed on two end supports. Pressure on top of the wheel rim removes the compression on the spring at the bottom so that the holes in the rim and the plug insert can be aligned. Then when the caps screws are applied, the wheel is ready for service. This method of removing and applying springs was developed by R. C. Flood.

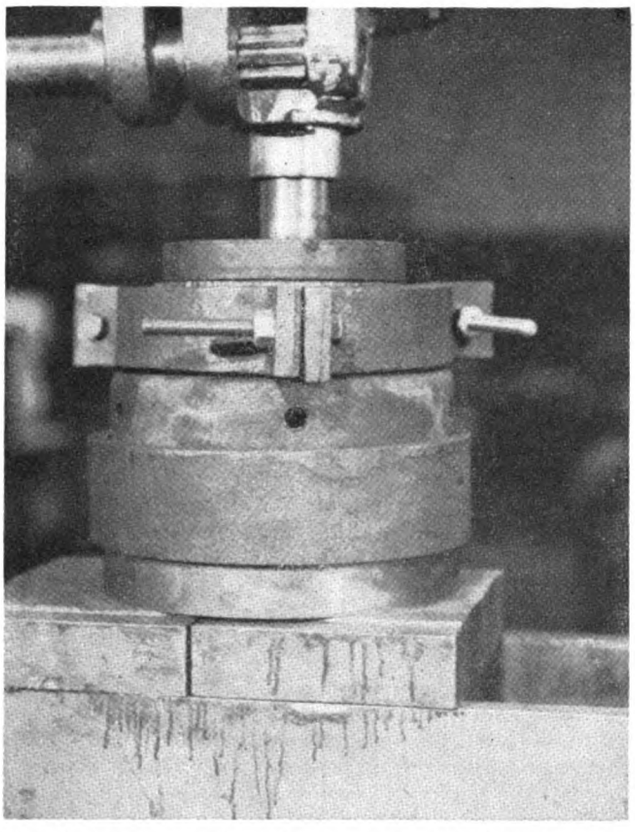


Fig. 4—The springs have been compressed by the three-part ring at the top and are being pushed down into a wheel rim which rests in a recess in the jig at the bottom

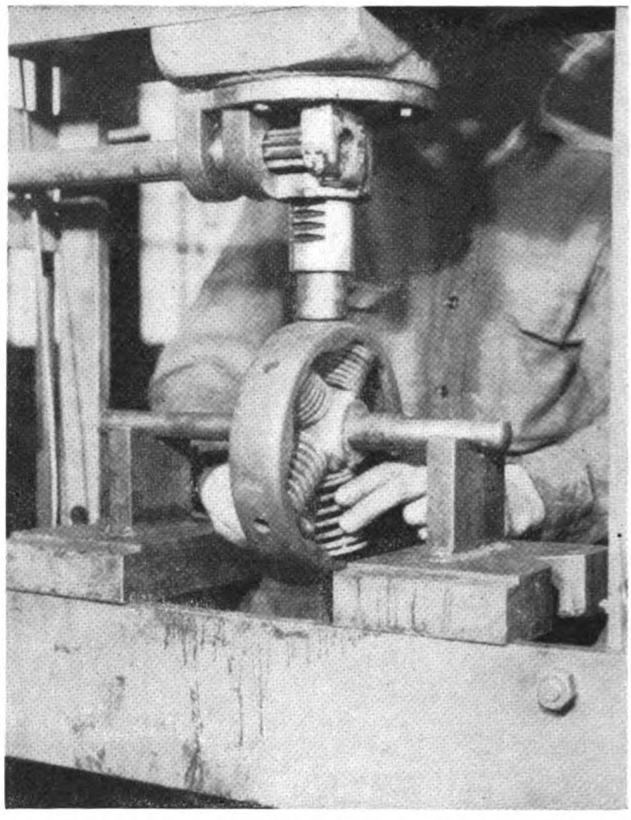
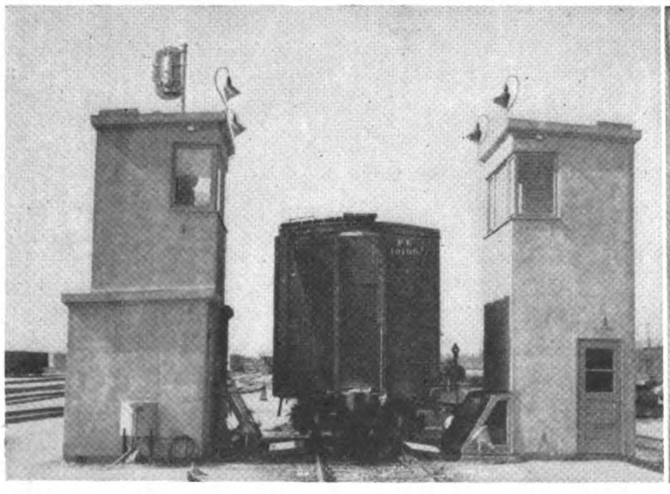
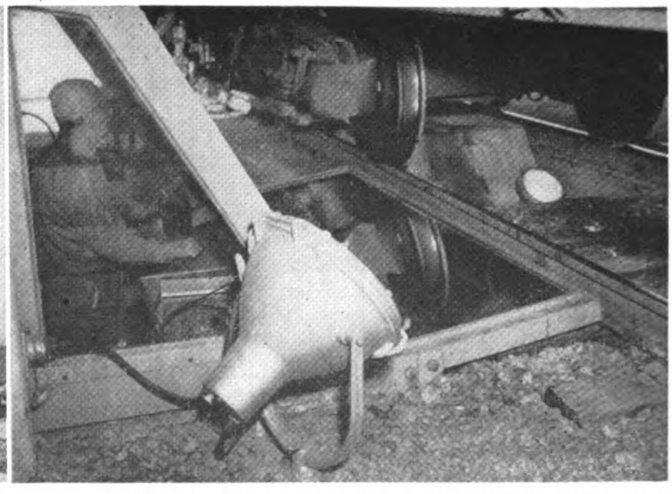


Fig. 5—Aligning a set of springs to match the holes in the retainer plugs to the cap screw holes in the wheel rim

* * *





Left: Observation towers built and equipped by the Southern Pacific at Los Angeles for inspecting freight cars entering the classification yards. The upstairs lookouts check the car roofs while the trucks and underframe are inspected with the mirror arrangement at the lower level. Right: Good lighting and properly located mirrors make truck inspection easy and complete

CONSULTING DEPARTMENT

Employee Morale

Proper maintenance of diesels requires facilities, material and skilled men interested in the work. How can morale be made an active factor in the diesel shop?

The Building Blocks of Morale

Morale in the diesel shop is a very important factor. However, it is an established fact that high morale, with resultant high efficiency, cannot be fully realized unless discipline is maintained. It is also an established fact that diesel foremen and diesel supervisors must lead their men; not drive them, as was often the case during early railroading days.

No factors are more important in building the morale of the workmen, improving shop conditions, increasing output and keeping crews happy in general, than the following Discipline, capable supervisors, knowledge and education, cooperation and responsibility.

Discipline.—Discipline is within the immediate scope of the diesel foremen and diesel supervisors. In the event a workman makes a major mistake, or violates established rules, prompt disciplinary action should be taken in order that the morale of the entire shop not be endangered. By the same token, if it should be necessary for a diesel foreman or diesel supervisor to take disciplinary action, he should be supported by higher officials, if the action is justified.

Capable Foremen and Supervisors.—These men should, of course, be competent in their particular assignments and should be able to lead their men and help them in their efforts to do their jobs efficiently. A mistake should be called to a workman's attention in such a manner that he will not feel he is being reprimanded, but in such a manner that he realizes the supervisor or foreman knows the mistake was not purposely made, and that the supervisor or foreman is there to show him the correct way of doing the job and to help him avoid making that mistake a second time.

Knowledge and Education.—Diesel foremen and diesel supervisors should, through the medium of company bulletins and periodicals, keep the men informed, (to a point prescribed by company officials), on developments and/or improvements contemplated, which will result in better working conditions. Too often it has been found that the "sand house" has been working full time concerning rumors of "big things" in the making, and the actual facts are obscured.

Cooperation.—Diesel foremen and diesel supervisors should be encouraged to lend heeding ears to suggestions made by men in the shops. A man's interest in his work can be dampened and his morale lowered if he is convinced that his suggestions appear to be worthless in the eyes of his superior officers. In many instances these suggestions are worthwhile and bear consideration. Cooperation between the workmen and their foremen and supervisors will bring these suggestions to light, and the morale of the workmen should be higher.

Responsibility. It should be impressed on all workmen that their jobs are their particular responsibilities, and that they are equally as important as any other jobs in the diesel shop. They should be made to realize that their particular jobs, no matter how small, are integral parts of the whole job of repairing and maintaining diesel locomotives. No man, in whatever capacity, can be expected to produce "extra effort" unless he is assured that his superior officers are aware of his effort, and appreciate it.

While I firmly believe that morale in the diesel shop is, generally speaking, high, I believe too, it can be improved. This will, of course, result in efficiency, increased output and contented, satisfied crews.

H. C. TAYLOR
Diesel Superintendent
Southern Railway System

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—If a cell voltage was fairly close to the other cell readings and the specific gravity low, what would you say was the cause?

A.—Loss of electrolyte due to overflushing or leaking container.

Q.—How do you arrive at 74 volts for the regulator setting?

A.—A standard value cannot be given as this depends on conditions. As a starting point, 74 to 75 volts is usually used for a 32-cell battery. A careful check of the specific gravity will enable you to determine whether the voltage regulator is correct, too high or too low. Excessive water consumption is an indication of too high a charge rate and the voltage setting should be reduced. Dropping off of specific gravity is an indication of insufficient charge and the voltage regulator setting should be increased. However, it is recommended that the voltage setting be changed no more than ½ volt at a time.

Q.—Why should the engine be running when making voltage readings?

A.—Unless the engine is running at the time voltage readings are being taken, there is no current going through the battery, resulting in open circuit voltage readings, as pointed out in a previous question.

Q.—Should the regulator be set at a higher value for winter than summer?

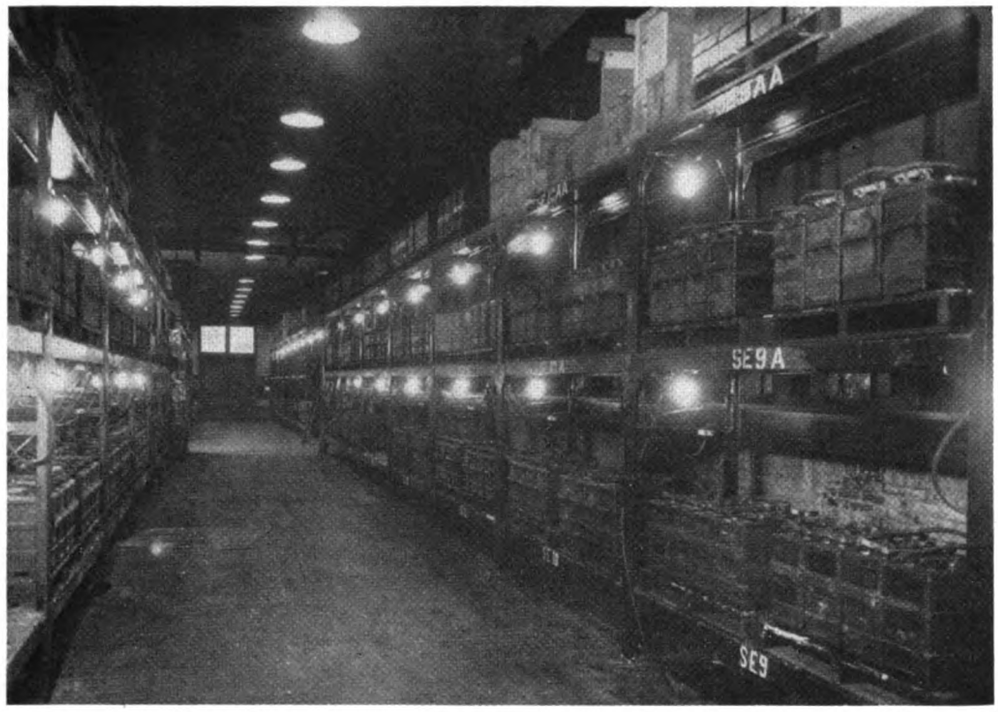
A.—This depends entirely on the operation. In extremely cold climates, it may be necessary to use a higher voltage setting in winter than in summer.

Q.—Should an equalizing charge be given a battery?

A.—An equalizing charge is not necessary if proper voltage regulator setting has been established.

Q.—How much difference in gravity would indicate that a battery needs equalizing or not?

A.—Any variation between cells of 20 points or more in specific gravity is an indication that the battery might need an equalizing charge. This might be due to too low a voltage regulator setting over an extended period of



A bench discharge will determine the actual capacity of a battery

time, which will result in a sulphated battery and considerable variation in specific gravity.

Q.—Is the finish rate on the name plate the right rate for equalizing?

A.—Yes. Although a lower rate may be used if sufficient time is available.

Q.—If a battery is very low, is it allowable to start with a charge higher than starting rate on name plate, and if so, how much higher?

A.—Yes. A higher starting charge rate may be used. A rate 2½ times that of the starting rate on a name plate may be used, provided that when gassing of the cells begins, the rate is lowered to the normal finishing rate.

Q.—Should the ammeter in cab show a charge when running?

A.—Yes. The ammeter reading will be high immediately after starting the engine, but will drop off sharply after the engine has been running a short time.

Q.—Should there be any difference between battery voltage at the battery switch and at the regulator?

A.—There will be some difference between battery voltage at the battery switch and the regulator, and this is usually due to the resistance in the circuit.

Q.—Is it safe to use an electric welder to charge a battery, regardless of the d.c. voltage of the welder if the amperes can be controlled?

A.—An electric welder can be used to charge a battery, provided caution is used in controlling the rate of charge.

Q.—What shall I use as a guide for correct regulator setting?

A.—A standard value cannot be given as this depends on the working schedule of the locomotive and atmospheric conditions. As a starting point 74 to 75 volts is usually used for a 32-cell battery. A careful check of the specific gravity will enable you to determine whether the voltage regulator is correct, too high or too low. Excessive water consumption is an indication of too high a charge rate, and the voltage setting should be reduced. Dropping off of specific gravity is an indication of insufficient charge and the voltage regulator setting should be increased. However, it is recommended that the regulator setting be changed no more than ½ volts at a time.

Q.—How should the regulators be checked?

A.—Voltage regulators should be checked with the engine r.p.m. at idling and running speeds. Make sure that the engine r.p.m. is within the limits specified by the manufacturer. The best time to check a voltage regulator is when the coils become hot to the touch, about two or three hours after the engine has been running.

Q.—If during an emergency the battery is discharged a half or more, should it be brought back to fully charged condition from an external source or let the auxiliary generator bring it back up?

A.—Let the auxiliary generator bring it back to full charge.

Q.—Before a regulator setting is changed, should a check be made to see if any irregular operations occurred to cause a temporary drop in gravity?

A.—Yes. Due to any difficulty with other parts of the locomotive, it may become necessary to start and restart the locomotive many times which will result in discharge to the battery.

Q.—What do we do if the battery becomes discharged in service due to faulty regulator or charging equipment?

A.—If the battery becomes discharged to such a low value that it will not start the diesel, it is imperative that an outside source of charge be obtained. If the regulator has been faulty over a long period of time, it is recommended that the battery be "shopped" and a prolonged equalizing charge be given to make sure that all cells are returned to a good healthy condition.

K. A. VAUGHAN
Gould Storage Battery Corporation

EDITORIALS

Failures of Truck Side Frames

Present railroad records of miles per hot box in freight as well as passenger service do not look too bad on paper and yet are subject to constant challenge, primarily because possible serious consequences make even a single hot box one too many. Similarly, truck side frames and bolsters occupy, along with wheels, axles and journals, a spot of pre-eminent importance in relation to safety. Hence, the goal sought must always be perfection in all practices pertaining to side frame inspection and maintenance.

One of the difficulties recently re-emphasized in a circular letter from the A.A.R. Mechanical Division is the possibility of cracks developing in these important steel castings and remaining undetected on account of being covered up with one or more coats of heavy paint. There is nothing new about this trouble which is thoroughly covered by Interchange Rule 3, Par. (t) (3-e), as follows: "New or secondhand truck sides and truck bolsters must not be painted with heavy asphaltic, tar or cement base paints: However, such parts may be coated with light bodied paint that will not prevent detection of flaws or cracks in ordinary inspection. Car wheels must not be painted. Note.—Existing truck sides and bolsters painted with heavy base paint, or having accumulation of rust scale, must have such paint and scale removed when cars receive general repairs."

Evidence that these instructions are not being strictly adhered to will be afforded by close scrutiny of cars in any freight yard, and a specific example of costly failure, occurring not long ago, has brought the subject into the limelight again. In this particular instance, the car involved had recently been repaired and all truck sides painted contrary to the rule. An old fracture in one side frame, located in the bottom member 5¾ in. from the journal box and amounting to 50 per cent of the cross section area, was not detected; the truck side failed under shocks and stresses incident to regular train operation; cars were derailed with attendant serious damage to lading and equipment.

Of course all truck side failures are not due to the painting over of defects. In another instance, a worn spring seat reduced the cross section area to such an extent that a sudden increase in shock load or stress caused a clean break in the metal which was entirely unpainted. In this case, the inspector who saw the car last simply overlooked the worn condition of the side frame just as other inspectors sometimes fail to appreciate the importance of the regulation against painting.

The point may be made that even one light coat of a fairly-liquid paint has some tendency to cover up defects, but unless protection is afforded to steel truck sides, especially in outdoor storage, corrosion will set in and not only in itself make the detection of defects somewhat difficult, but actually reduce stress resisting cross-section areas. No general objection, therefore, is made to the use of light-body paint as specified in Rule 3. What really does the damage, potentially if not in fact, is the application of heavy lead paints to railroad car trucks and asphalt-base paints such as are often used on refrigerator car trucks to prevent corrosion from brine drippings. While this is a highly-desirable objective, some other solution of the problem should obviously be sought and the regulation against heavy painting of truck sides and bolsters more carefully policed both by railroads and private car owners, the latter of whom are said to be particular offenders.

Keep 'Em Rolling

Beginning with the July, 1951, issue, the *Railway Mechanical and Electrical Engineer* will run a series of articles called "Diesel-Elecertics—How To Keep 'Em Rolling." They will cover the fundamentals of design, operation and maintenance, and will deal largely with electrical equipment. But, since most things electrical are largely mechanical, and since so much of a diesel is partly electrical, the scope of the articles will include nearly everything but the engine.

It is the electrical equipment on a diesel-electric locomotive which is least understood and the subject matter of these articles is so prepared that it will be of interest not only to the mechanical and electrical men in the shops, but also to the operating men, the supervisors, and in fact, nearly everyone on the railroad.

Supervisors find that the best men are frequently responsible for some kinds of trouble which are not caused by those with a lower I.Q. The reason for this is that they want to know why they are given certain instructions. Accordingly, they try things which have not been made clear to them. The why, as well as the how, is included in these articles.

Builders conduct training courses for railroad men who want to learn about the diesel. They afford the best available means of learning a lot about them, fast. Unfortunately, the great majority of railroad men cannot get away from their work to attend these courses, and those who can, must limit the time they can give to them. Railroads have their own courses of instruction. The series of articles should serve effectively to supplement the work done by the schools, and will provide a permanent record for reference. No one can long remember all the things he has learned, particularly if the teaching

has been concentrated over a short period of time. The articles on file will serve as a reference to those who have taken courses. They will also extend the needed information to the great bulk of men who do not have the opportunity to attend schools.

If you are a subscriber, plan to save your copies. If you have friends, who you think would like to know about the series, tell them.

Better Cars Is Good Business

Properly maintaining and equipping a freight car has as its ultimate objective the making of the maximum profit for its owner as well as for other roads over which it operates. As profit is the difference between income and outgo, it is as dependent on the former being large as it is on the latter being minimized. This being true, the role of equipping and maintaining cars in the best manner is a function of the car department no less important than keeping the cost of running the department to a minimum.

Cars properly equipped and maintained accomplish two essential objectives—gaining traffic and reducing damage. Yet the car department may have difficulty getting the extra money to assure this condition because it will quite often increase rather than decrease the cost of operating this department. While the savings to the railroad from reducing damage claims can be very large and very real, and the value of the additional business to be gained can be substantial, it may be difficult to correlate the benefits with the costs as one department stands the charges while others reap the benefits.

The problem of how far to go in better equipping and maintaining cars is further complicated by the owner getting only part of the benefits from the better cars, and the same is true of the money spent for test and development work in providing better cars for the shippers. Despite these and other complications that arise in carrying out a program to provide cars that will give improved service, every effort should be expended to do just that for both present and future need. It is necessary now with the high volume of traffic to reduce damage claims and delays to loaded cars en route. It will be still more necessary in the future to do all possible to gain and retain traffic when highly competitive conditions return. Car men can render their roads a real service by always being alert to all means of giving the shipper a better car, and by pointing out how expenditures for providing these better cars is money well spent.

NEW BOOKS

THE BEHAVIOR OF ENGINEERING METALS. *By H. W. Gillett, Battelle Memorial Institute. Published by John Wiley & Sons, 440 Fourth avenue, New York 16. 395 pages, 6 in. by 9½ in., cloth bound. Price, $6.50.*

The material in this book, presented from the viewpoint of the metallurgist for those who have not specialized in the field, is intended to help in choosing suitable engineering materials. The behavior of these materials is discussed, rather than the sometimes abstruse theories that seek to explain their behavior. Technical terms have been used as little as possible and, where a choice existed, references have been selected for easy reading as well as for technical content. The terms in the first six chapters, which discuss the basic concepts of metallurgy, are introduced in natural sequence, and examples show how they are used. The next nine chapters deal with the behavior of each of the principal commercial metals and alloys. The remaining chapters, discuss machinability, special fabricating techniques, means of using or selecting metals so as to combat the effects of corrosion, wear, and high temperature, and other special considerations that may influence the selection of metals and alloys. Alternate Materials, Cost, Conservation, codes are taken up in the closing chapter.

OXYGEN CUTTING. *By George V. Slottman, director of research and engineering, and Edward H. Roper, assistant technical sales manager, Air Reduction Sales Company. Published by McGraw-Hill Book Company, New York. 395 pages, 6 in. by 9 in., cloth bound. Price, $6.50.*

This book has been assembled with the aim of providing sufficient technical and historical background to stimulate interest in the advancement of oxygen cutting. Much of its information has been drawn from the literature and from the practical experience and research work of the authors and their associates. It is arranged in quick reference form and presents a detailed picture of oxygen cutting, the equipment and techniques used in the process, and varied applications of the process, both old and new. Flame machining, flame scarfing, underwater cutting, rock drilling, electronic tracers for cutting machines, and developments in heavy cutting are among the recent advances in the field which the book covers. Special chapters are devoted to metal temperature, plant facilities, hand and machine cutting, types of cutting machines, multiple and stack cutting, etc. The book summarizes the action of the jet and the cutting process for the practical operator and the research worker.

NEW DEVICES

Simplified Heating System

A simplified heating system has recently been installed in a coach modernized by Union Pacific. Known as the Economy system, controls for the installation are the products of the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. This approach to the railroad passenger car heating problem is an attempt to give controlled, over-all comfort throughout the car with a minimum of piping and controls.

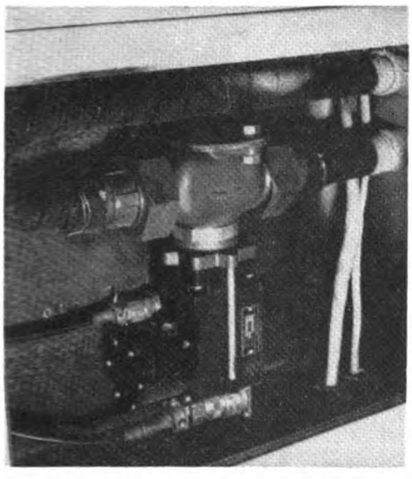
Heating units consist of conventional finned pipes running the length of each side of the car through which a smaller steam tube is installed. A return pipe is connected to this heat exchanger making a closed hot water circulating system. Steam is introduced into the inner steam tube, and electrically driven pumps on each side of the car circulate the water. Actually, a non-freezing solution is used instead of water. When parked on standby steam service, the circulators do not operate but temperature control is maintained by a self-operated valve in the steam line that requires no electrical power.

Within the air-conditioning system, an overhead steam heat coil is installed to temper the incoming air and provide for air circulation throughout the coach.

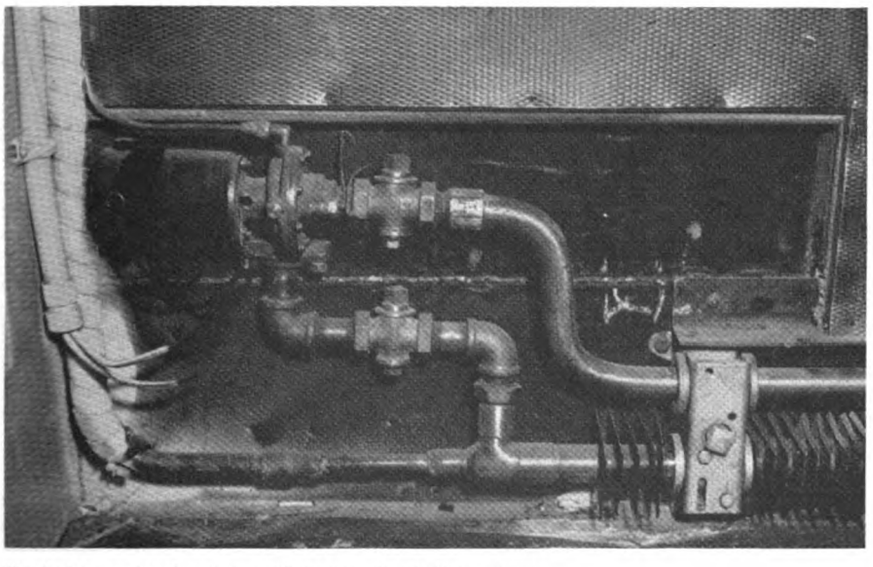
Three thermostats are used in the car for temperature control, one car thermostat, a fresh air thermostat and a discharge air thermostat. These thermostats work as a team, registering in an electronic relay to control the operation of the single motorized valve which meters the steam to the car's heating system. Through this valve, the steam is controlled to the floor heat radiation units and also to the overhead coil in the air conditioning system.

This single motor-operated valve takes the place of three previously used in car heating designs of this type. It modulates the flow of steam in order to correct gradually for temperature variations and gives more even heating comfort, according to the manufacturer. As an integral part of this same valve, end switches also control the air conditioning for cooling the car.

Piping under the car has been reduced and simplified with this new system which takes less installation time and should ease maintenance and inspection. Layout, design and installation has been done by Union Pacific forces with Minneapolis-Honeywell furnishing the thermostats, motorized valve and the steam reducing valve.

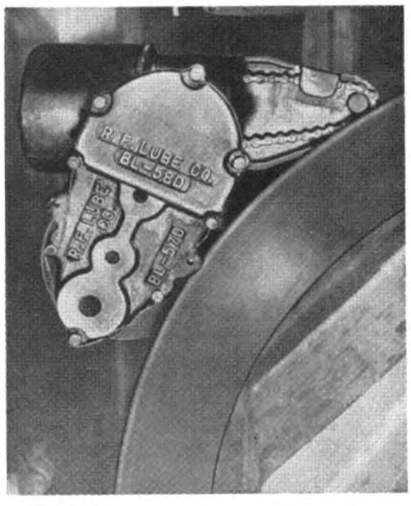


Motorized steam metering valve



Radiation unit showing anti-freeze circulating pump

The newly-modernized coach is the last of a series of 70 to go through the company's car shops in a program which began a few months ago. The car is now in service where the new heating system will be under close observation and have a chance to show how it functions under widely-varying load and temperature conditions.



Mechanical Rail Flange Lubricator

A lubricator has been designed and constructed to put a small amount of graphited grease where it will properly lubricate the flange, but will not get on the wheel tread or rail top. This action is accomplished by a gear-driven roller-chain that runs through a reservoir of graphited grease which is mixed by rotating agitators.

A small amount of graphited grease is carried by the roller-chain and deposited on the wheel flange. The chain after leaving the reservoir, is guided to the flange and protected from the weather by an applicator that is hinged at the top to follow the lateral movement of the wheel.

This mechanical rail flange lubricator is manufactured by the Rail Flange Lubricator Co., Portland 10, Ore. It is a ruggedly built, self-contained complete unit that mounts on the spring saddle of steam locomotives and the journal housing on diesels.

On logging roads equipped with the lubricators, friction drag has been reduced without loss of power due to slippage, making it possible to pull much heavier loads than was possible prior to the installation of Burrell Lubricators on the locomotives.

According to the manufacturer, the lubricators are designed and constructed to withstand engine vibration and road shock, yet function with a minimum of service. The large grease container is easily filled with a grease gun in a few minutes, and the reservoir holds enough grease for a run of 300 to 500 miles. They can be easily installed on all types of diesel and steam locomotives.

Strain Gage Tests Steam Chest

Design of this steam chest fabricated by the General Electric Co., was based to a large extent on resistance wire strain gage measurements on the walls, cover and bolts. Type SR-4 gages developed by the Baldwin-Lima-Hamilton Corp., Eddystone, Pa., were bonded to the interior and exterior walls at 14 points and to the center of the cover. Four additional gages were bonded 90 deg. apart on each of two studs in the centerline of the long sides and cover so as to give axial strains and stresses.

Leads from internal gages were taken through piping used in applying hydraulic pressure to the chest, to a manifold having six automobile spark plugs fitted to it. Lead wires were soldered to the center electrodes on the inside and connections were made to the outer terminals.

Strains were measured when the pressure in the chest had been raised to 1,200 lb. per sq. in., double normal operating pressure. The system was filled with SAE-10 oil and the pump was used to produce the desired pressure. A 21-point transfer switch was used with the Baldwin strain indicator to speed up the testing and calculating program.

Results of the tests were the basis for a decision to build steam chests with curved walls whenever practical and to fasten the cover to the flanges by studs located inside the centerline of the walls where they join the flange. The gages showed further that stud bending moments may be excessive unless nuts and bolts are carefully produced to as to keep nuts parallel to the cover.



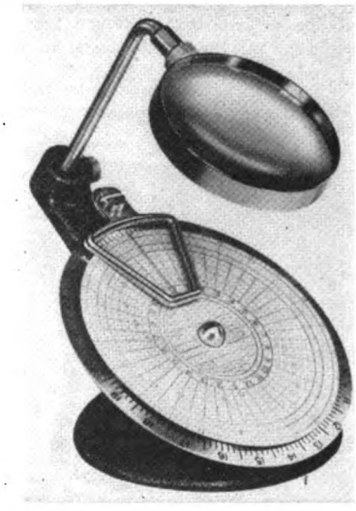
Charger for Locomotive Batteries

A selenium rectifier has been developed by the Vapor Heating Corporation, Chicago, in cooperation with the Triple A Specialty Company, Chicago, to convert 110- and 220-volt a.c. power to 74-volt a.c. to operate Vapor hot water heaters on freight and switcher diesel locomotives and railroad passenger cars during overnight standby periods.

The rectifier supplies 12 amp. for sustained periods to operate the hot water heater motor which drives the blower and fuel pump and supplies a trickle-charge current to the storage batteries, to keep the batteries from freezing, and to maintain them at high efficiency. The trickle-charge rate is controlled by a standard type incandescent lamp, making it easy to increase the charging rate by using a higher wattage lamp.

The overall dimensions of the rectifier are 20 in. high, 10 in. wide and 10 in. deep, including the wall mounting brackets.

Mr. Kittredge was born in Sharon, Pa., and is a graduate of Cornell University (in 1939). He served as a naval officer during World War II, joining National Malleable at Indianapolis, Ind., in 1946. He was transferred to the Railway division at Cleveland, Ohio, as assistant sales manager.

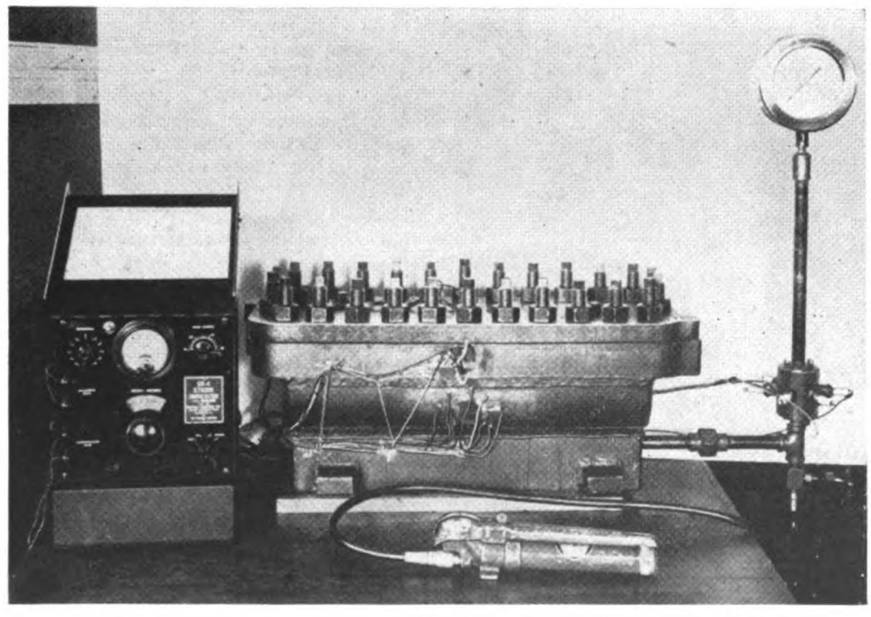


Switch Engine, Recorder Chart Analyzer

A chart analyzer has been developed for use in reading and analyzing the Barco switch engine recorder charts. It was designed for increasing the efficiency of railroad switching operations.

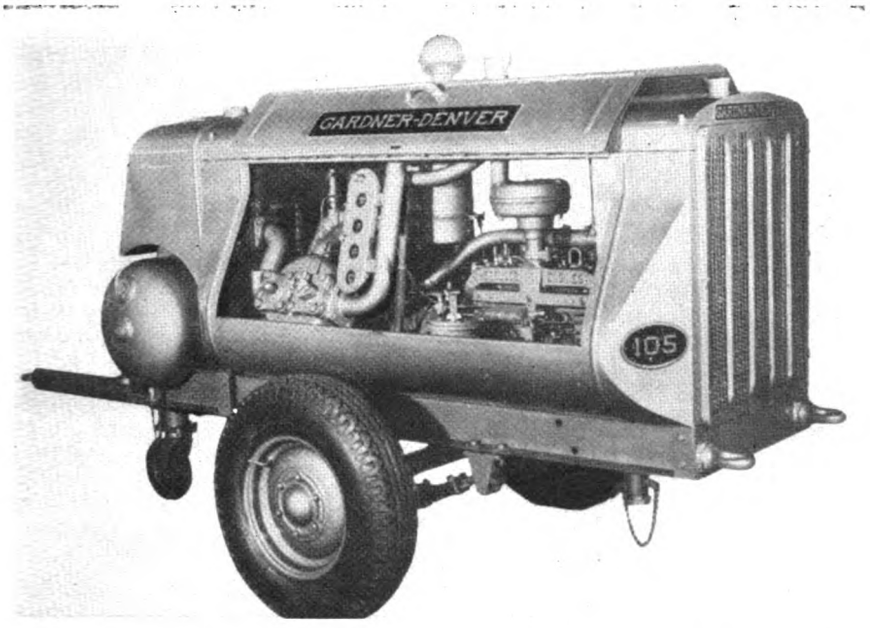
Records made by the device includes idle time, operating time, number of miles traveled and speed during an eight hour period.

The apparatus, made available by the Barco Mfg. Co., Chicago 40, Ill., consists of a convenient, circular, revolving plate with hair line indicator and reading glass which facilitates the reading of charts and listing of data on a simple report form.



Two Stage Air Compressor

Recently introduced to the trade by the Gardner-Denver Co., Quincy, Ill., is a two stage, portable air compressor, model WH-105 powered by a Hercules QXD-5 gasoline



engine. This engine, built by Hercules Motors Corp., Canton, Ohio, is a 6 cylinder unit with a $3\frac{7}{16}$ in. bore and $4\frac{1}{8}$ in. stroke. The piston displacement is 230 cu. in.

The gasoline engine is equipped with an oversized, gear driven oil pump which provides pressure lubrication to all main, connecting rod and idler gear bearings. A cooling system is provided by full length water jackets around all cylinders and by a positive gear driven water pump. This pump is designed to eliminate misalignment and undue wear on vital parts.

The compressor provides the user with an all water cooled 105 cu. ft. per min. unit which assures cooler air to the tools and thus keeps tool upkeep to a minimum. Being a two-stage air compressor, it assures adequate rated capacity at any altitude. Air is compressed to 28 lb. in the first stage, cooled back to almost atmospheric temperature in a radiator-type intercooler, and boosted to final discharge pressure in the second stage. An unloader pilot operates the suction unloading valves within a fixed range and automatically throttles the engine to idling speed and unloads the compressor.

This compressor is furnished on two or four wheeled spring mounted running gears and also on wood skids for truck mounting.

Diesel Fueling Alarm Signal

The Ventalarm signal developed by the Scully Signal Co., Cambridge 41, Mass., audibly indicates its presence on the tank at the start of the fill. For installation on diesel locomotives, on their fuel tanks, it provides attendants with a positive fueling guide.

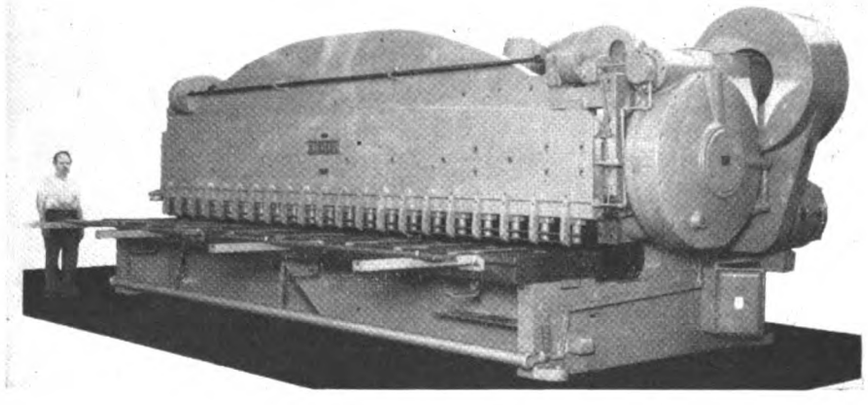
When fueling starts, the venting vapors forced out of the tank by the incoming liquid blows a sensitive whistle incorporated into the signal assembly. The whistle sounds continuously until the rising liquid seals the signal intrusion tube. This tube projects into the tank at a predetermined distance. When the whistle stops, the attendant simply stops filling.

The unit offers many advantages including elimination of dangerous, wasteful and messy overflow spillage during fueling. It permits faster servicing and makes it possible to fuel at faster pump rates without loss of time in topping-off operations. Night filling is simplified as the mental strain on the filling attendant is relieved.

The whistle in the alarm signal operates at a pressure of 0.5 oz. per sq. in. On sealing of the intrusion, either in the Standard or Remote types, there is no decrease in adequate venting area. Further vapor venting bypasses the intrusion and the whistle.

All Steel Squaring Shear

A shear with a capacity of 20 ft. of ½ in. mild steel plate is the latest addition to the line of All-Steel Squaring Shears manufactured by The Cincinnati Shaper Co., Cincinnati 25, Ohio.



This device, weighing over 135,000 lb. has a speed of 20 strokes per min. It is equipped with hydraulic hold-downs capable of exerting a holding force of over 70 tons. The hold-down pistons are made with automobile type piston rings for long life and have a unique vacuum pump arrangement that prevents leakage of hydraulic oil. It has a 24 in. throat or gap and a 48 in. back gage range

Standard equipment includes four edge high carbon tool steel knives with straight sides and a section measuring $1\frac{3}{4}$ x $6\frac{1}{2}$ in. ball bearing back gage with graduated dials, automatic lubrication, hinged angle and complete guarding.

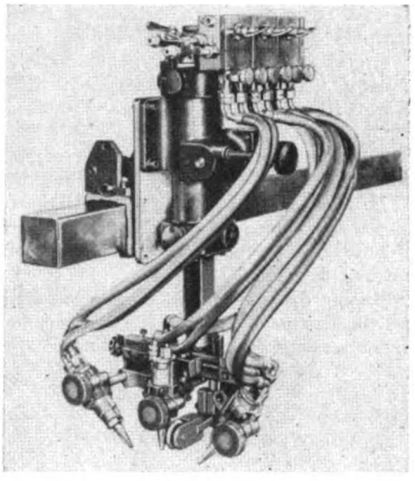


Plate-Edge Preparation Device

The Airco plate-edge preparation device which employs a spring-balanced, free floating carriage and caster-wheel assembly to permit bevel cutting over plate undulations while maintaining a constant tip-to-work distance, may be mounted on any gas cutting machine equipped with a 3-in. square torch bar.

This device manufactured by the Air Reduction Sales Co., New York 17, N. Y., has been designed to increase production and insure accurate preparation of plate

(*Continued on page 122*)

NEWS

Ontario Section Host at A.S.M.E. Semi-Annual Meeting

THE Royal York Hotel, Toronto, Ont., will be the headquarters for the semi-annual meeting of the American Society of Mechanical Engineers June 11-14. The Engineering Institute of Canada will co-sponsor several sessions. The American Rocket Society and the Institute of Aeronautical Sciences will also participate in the meeting. More than 80 papers will be presented in 38 technical sessions. The Right Honorable C. D. Howe, Canadian Minister of the Department of Defense Production, will address the banquet of the Society on Wednesday evening, June 13. C. J. MacKenzie, chairman of the National Research Council in Canada, will deliver the Roy V. Wright Lecture at a luncheon on Tuesday, June 12.

Among the sessions are three sponsored by the Railroad Division. The program for these sessions is as follows.

WEDNESDAY, JUNE 13
2:30 p.m. DST
Railroad I—Fuels III

Air Pollution and Smoke Abatement, Owen R. Barefoot, superintendent motive power and car department, Canadian Pacific.

Symposium on Performance Experienced with Double-Screened Locomotive Fuels. To be participated in by

E. C. Payne, consulting engineer, Pittsburgh Consolidation Coal Co.

J. W. Swan, fuel conservation engineer, Louisville & Nashville

W. O. Cottingham, supervisor locomotive performance, Western Maryland

H. G. Pike, superintendent equipment, Pittsburgh & Lake Erie

R. M. Pilcher, assistant engineer of tests, Norfolk & Western

THURSDAY, JUNE 14
9:30 a.m. DST
Railroad II

Recent Developments in Oil-Burning on Steam Locomotives, W. A. Vanderland, research engineer, Department of Research, Canadian Pacific.

Development Potentialities of the Alberta Oil Fields, Dr. O. B. Hopkins, vice-president, Imperial Oil Limited.

THURSDAY, JUNE 14
2 p.m. DST
Railroad III

Development of the Opposed Piston Diesel Engine, George A. Mueller, general sales manager, Canadian Locomotive Company.

"Power to Stop," a motion picture on the braking of passenger cars produced by American Steel Foundries.

Gas Turbine Electric Locomotive Has Handled 363,816 m.g.t.m.

Operation of the General Electric Company's gas-turbine-electric locomotive on the Union Pacific was terminated on March 31, 1951. It was shipped to the Union Pacific on July 28, 1949. The first few weeks were spent on a tour, and actual operation in freight service was begun August 22, 1949. From this date to March 31, 1951, the locomotive operated a total of 94,885 miles, produced 344,950 m.g.t.m. of service and burned 1,448,787 gal. of fuel, of which about 95 per cent was bunker C oil. This is an average of 4.2 gal. per m.g.t.m. and an average weight of train of 3,635 tons.

Since November 1, 1948, which is the approximate date the locomotive was placed

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of January 1951	1950
3	Road locomotive miles (000) (M-211):		
3-05	Total, steam	28,876	27,397
3-06	Total, Diesel-electric	20,921	15,201
3-07	Total, electric	838	765
3-04	Total, locomotive-miles	50,635	43,364
4	Car-miles (000,000) (M-211):		
4-03	Loaded, total	1,749	1,370
4-06	Empty, total	852	794
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):		
6-01	Total in coal-burning steam locomotive trains	48,863	40,985
6-02	Total in oil-burning steam locomotive trains	11,727	10,268
6-03	Total in Diesel-electric locomotive trains	57,675	41,764
6-04	Total in electric locomotive trains	2,275	1,987
6-06	Total in all trains	120,546	95,010
10	Averages per train-mile (excluding light trains) (M-211):		
10-01	Locomotive-miles (principal and helper)	1.05	1.05
10-02	Loaded freight car-miles	38.50	35.20
10-03	Empty freight car-miles	18.80	20.40
10-04	Total freight car-miles (excluding caboose)	57.30	55.60
10-05	Gross ton-miles (excluding locomotive and tender)	2,653	2,440
10-06	Net ton-miles	1,244	1,073
12	Net ton-miles per loaded car-mile (M-211)	32.30	30.50
13	Car-mile ratios (M-211):		
13-03	Per cent loaded of total freight car-miles	67.20	63.30
14	Averages per train hour (M-211):		
14-01	Train miles	16.60	17.20
14-02	Gross ton-miles (excluding locomotive and tender)	43,471	41,371
14	Car-miles per freight car day (M-240):		
14-01	Serviceable	45.50	38.90
14-02	All	43.40	36.10
15	Average net ton-miles per freight car-day (M-240)	942	697
17	Per cent of home cars of total freight cars on the line (M-240)	34.50	50.90

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000):		
3-05	Steam	12,584	12,376
3-06	Diesel-electric	16,001	14,120
3-07	Electric	1,715	1,662
3-04	Total	30,300	28,159
4	Passenger-train car-miles (000):		
4-08	Total in all locomotive-propelled trains	292,751	269,271
4-09	Total in coal-burning steam locomotive trains	67,727	61,803
4-10	Total in oil-burning steam locomotive trains	37,565	37,352
4-11	Total in Diesel-electric locomotive trains	169,210	151,973
12	Total car-miles per train-miles	9.58	9.35

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):		
1-01	Steam, coal-burning	1,447	1,422
1-02	Steam, oil-burning	259	267
1-03	Diesel-electric[1]	2,957	2,292
1-06	Total	4,692	3,967
2	Passenger yard switching hours (000):		
2-01	Steam, coal-burning	58	70
2-02	Steam, oil-burning	15	14
2-03	Diesel-electric[1]	246	229
2-06	Total	354	348
3	Hours per yard locomotive-day:		
3-01	Steam	8.50	7.20
3-02	Diesel-electric	18.10	17.30
3-05	Serviceable	14.90	13.40
3-06	All locomotives (serviceable, unserviceable and stored)	12.90	11.00
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.85	1.99
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.75	0.80

[1] Excludes B and trailing A units.



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on test in Erie, Pa., the total locomotive miless are 105,732. This includes mileage on the Pennsylvania, the Nickel Plate, and approximately 4,500 miles on the Union Pacific Tour. Since November 1, 1948, a total of 1,797,426 gal. of fuel oil have been burned. This includes some power plant testing on the water box when no locomotive mileage was produced. A total of 363,816 m.g.t.m. have been credited to the locomotive since November 1, 1948.

Mechanical Division Meets June 26-28

THE 25th annual meeting of the A.A.R. Mechanical Division will be held at the Congress Hotel, Chicago, June 26 to 28. There will be no exhibition of railway equipment and supplies in connection with this meeting. The program follows:

TUESDAY, JUNE 26

Address by a railroad executive.
Address by J. H. Aydelott, vice-president, Operations and Maintenance Department, A.A.R.
Address by Chairman, Mechanical Division, B. M. Brown, general superintendent motive power, Southern Pacific Company.
Report of General Committee.
Report of Nominating Committee.
Discussion of Reports on:
- Locomotive Construction:
  - Steam and Electric Locomotives Section
  - Diesel Locomotive Section
  - Gas-Turbine Locomotive Section
- Axle and Crank Pin Research
- Safety Appliances

WEDNESDAY, JUNE 27

Address by W. J. Patterson, member, Interstate Commerce Commission.
Discussion of Reports on:
- Arbitration
- Prices for Labor and Materials
- Brakes and Brake Equipment
- Geared Hand Brakes
- Loading Rules
- Special Committee on Forest Products Loading
- Specification for Materials
- Couplers and Draft Gears
- Lubrication of Cars and Locomotives
- Development of Hot Box Alarm Devices
- Progress Report—Join Committee on Railway Sanitation

THURSDAY, JUNE 28

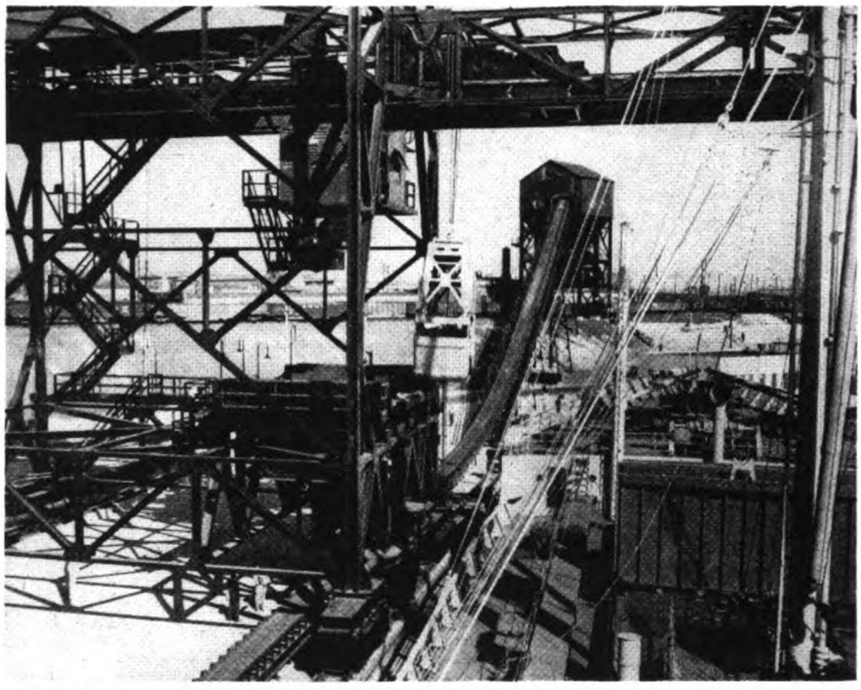
Discussion of Reports on:
- Tank Cars
- Wheels
- Car Construction

Election of members of General Committee and Committee on Nominations.

Locomotive Development Committee Moves to Dunkirk

THE offices of the Locomotive Development Committee, Bituminous Coal Research, Inc., have been moved from Baltimore, Md., to 320 South Roberts road, Dunkirk, N. Y. —P.O. Box 225.

John Yellott will continue as director of research and Peter R. Broadley as assistant director of research at Dunkirk.



This $5 million Baltimore & Ohio ore pier, dedicated by the road's president, Col. R. B. White, on May 15 at Curtis Bay, Baltimore, Md., can accommodate ocean-going ore carriers of up to 40,000 tons. The ore is scooped out of the ships' holds by 15-ton buckets. Smaller buckets are used for cleaning up operations. The buckets drop the ore into bins which feed it to a rubber conveyor belt, 48 in. wide and 895 ft. long. The belt has a sustained capacity of 2,000 tons per hour, and travels 400 ft. per min. It carries the ore to a scale-house where it is weighed automatically before it is deposited in waiting cars on the tracks below. Cars emptied at the adjoining coal pier are immediately available for loading with ore, thus eliminating turn-around movement. The ore pier is 650 ft. long and has two ore unloading machines on movable towers. It can be extended an additional 600 ft. and two more unloading machines erected on it.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE

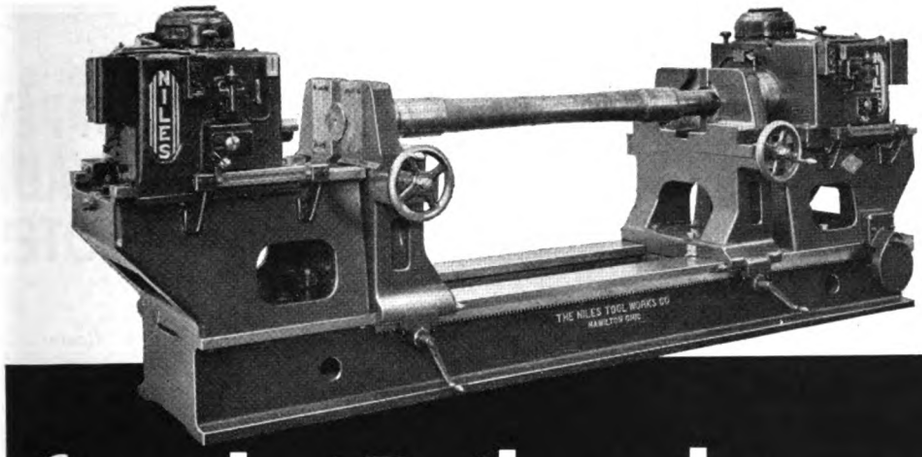
DIESEL LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Atlanta & West Point	1[1]	1,200	Switch	Baldwin-Lima-Hamilton
Chesapeake & Ohio	27[2]	2,250	Passenger	Electro-Motive
	21[2]	1,200	Switch	Electro-Motive
	59[2]	1,500	Road-Switch	Electro-Motive
Chicago, Burlington & Quincy	23[3]	1,500	Road switch	Electro-Motive
Chicago, Rock Island & Pacific	25	1,500	Road switch	Electro-Motive
	15	1,500	Double-control suburban	Alco-G. E.
	5	1,600	Road switch	Alco-G. E.
Gulf, Mobile & Ohio	3[4]	1,600	Road switch	Alco-G. E.
Lake Superior & Ishpeming	3[5]	1,000	Switch	Alco-G. E.
Minneapolis & St. Louis	3[5]	1,000	Road switch	Alco-G. E.
Missouri-Illinois	1[7]	1,600	Road switch	Alco G. E.
St. Johnsbury & Lamoille County	1[8]	600	Switch	Gen. Elec.
Spokane, Portland & Seattle	3[9]	1,200	Switch	Electro-Motive
	2[9]	1,600	Road switch	Alco-G. E.
Union Pacific	30	1,500	Freight	Electro-Motive
	16	1,200	Yard switch	Electro-Motive
	6	1,600	Road switch	Baldwin-Lima-Hamilton
United States Army	41	800	Switch	Electro-Motive
United States Steel Corp	8	1,200	Switch	Baldwin-Lima-Hamilton
	8	1,200	Switch	Fairbanks, Morse
Wabash	1[10]	2,250	Passenger	Electro-Motive
	12[10]	1,500	Freight	Electro-Motive
	10[10]	1,500	Road switch	Electro-Motive
	5[10]	1,200	Switch	Electro-Motive
	4[10]	1,500	Freight	General Motors Diesel Ltd.
	1[10]	1,500	Road switch	General Motors Diesel Ltd.
	1[10]	800	Switch	General Motors Diesel Ltd.

FREIGHT CAR ORDERS

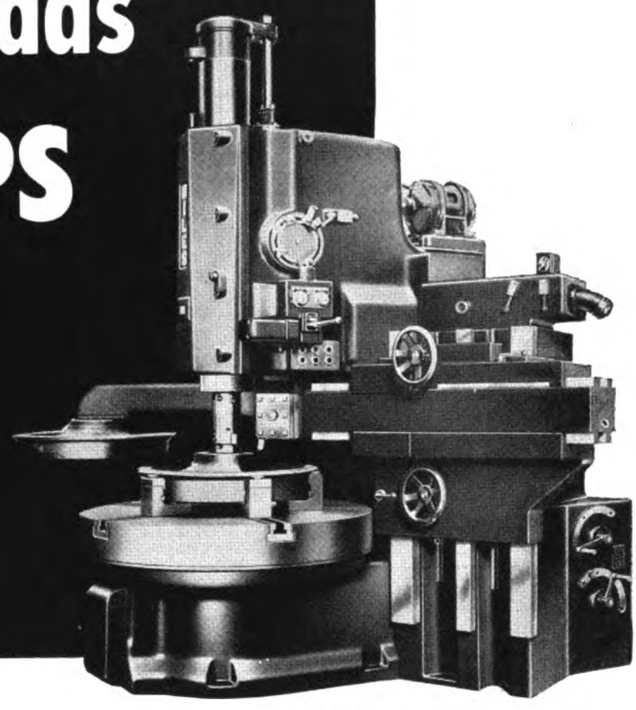
Road	*No. of cars*	*Type of car*	*Builder*
Canadian National	75[11]	70-ton-Hopper	National Steel Car
Clinchfield	500[12]	50-ton hopper	Pullman-Standard
Delaware & Hudson	500	50-ton box	Pullman-Standard
	500	50-ton hopper	Pullman-Standard
Detroit & Mackinac	100[13]	50-ton box	General American
Florida East Coast	75[14]	70-ton covered hopper	Pullman-Standard
Illinois Central	150[15]	70-ton hopper	General American
	100[17]	50-ton gondola	Pressed Steel Car

(Continued on page 98)

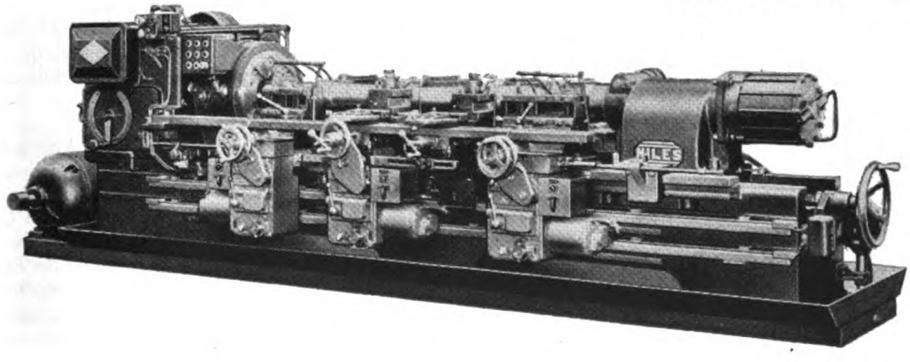


NILES Hydraulic Centering Machine. Centers new axles or renews centers on mounted or unmounted axles prior to turning. Permits easy checking of individual and related concentricity. Action is automatic. Assures high production and uniform dimensional results.

for the Railroads
for the SHOPS
TOOLS



NILES Hydraulic Diesel Wheel Borer. Speeds and feeds designed for carbide tools. Push button chucking and unchucking, automatic boring cycle. User reports: "Cast wheel every four minutes—steel wheel every six minutes."



NILES End Drive Axle Lathe. Developed after extensive research, to speed up this key operation. Machines axles over their entire length in ⅓ to ½ the time ordinarily required. Leaves no indentation from driving jaws.

LIMA-HAMILTON

OFFICES IN PRINCIPAL CITIES

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE *(Continued from page 92)*

Minn., St. Paul & Sault Ste. Marie	350[15]	50-ton box	Company shops
	200[16]	50-ton gondola	Company shops
New York Central	1,000[17]	55-ton hopper	Pullman-Standard
	2,500[17]	55-ton hopper	Despatch Shops
	1,000[17]	55-ton box	Despatch Shops
	50[17]	12,000-gal. tank	General American
	200[17]	Cabooses	St. Louis Car
Northern Pacific	250	70-ton gondola	American Car & Fdry.
Richmond, Fredericksburg & Potomac	50[18]	70-ton gondola	General American
Union Tank Car Co.	50[19]	11,000-gal. propane tank	American Car & Fdry.
Western Fruit Express Co.	500[20]	50-ton refrigerator	Company shops

FREIGHT CAR INQUIRIES

Denver & Rio Grande Western	1,000	70-ton gondola
New York, New Haven & Hartford	550	70-ton hopper
Spokane, Portland & Seattle	500	50-ton box

PASSENGER CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Wabash	1	Dome-parlor-lounge	Pullman-Standard

[1] Cost, $102,500. Delivery scheduled for August.
[2] Deliveries of the passenger units scheduled to begin in July and to be completed in November; switching units scheduled for delivery in October and November, the road-switching units delivery of which will start in October and completed in May, 1952. When these units are in service, the Pere Marquette district will be 100 per cent dieselized for all services, and the Chesapeake district will be dieselized 60 per cent for switching, 80 per cent for passenger service, and 11 per cent for freight service.
[3] Delivery scheduled for later this year.
[4] Approximate cost of $426,000. Delivery scheduled for September.
[5] Cost, $348,000. Delivery scheduled for November or December.
[6] Approximate cost $342,000. Delivery scheduled for October.
[7] Delivery scheduled for October.
[8] Cost, $78,000.
[9] Two of the switching units scheduled for delivery in September and the third in October. The road-switching units are scheduled for delivery in September.
[10] Delivery scheduled for 1952.
[11] To cost over $600,000.
[12] Approximate cost of each $4,900. For delivery in June, 1952.
[13] Approximate cost, $600,000. Scheduled for fourth-quarter delivery.
[14] Approximate cost $575,000. Delivery tentatively scheduled for the second half of 1952.
[15] Delivery scheduled for the second quarter of 1952.
[16] Delivery scheduled for early 1952.
[17] Cabooses to be received late this year. Other cars to be built next year.
[18] Cost $322,000. Delivery scheduled for the fourth quarter 1951.
[19] Delivery anticipated during the first quarter of 1952.
[20] Scheduled for delivery during the first quarter of 1952.

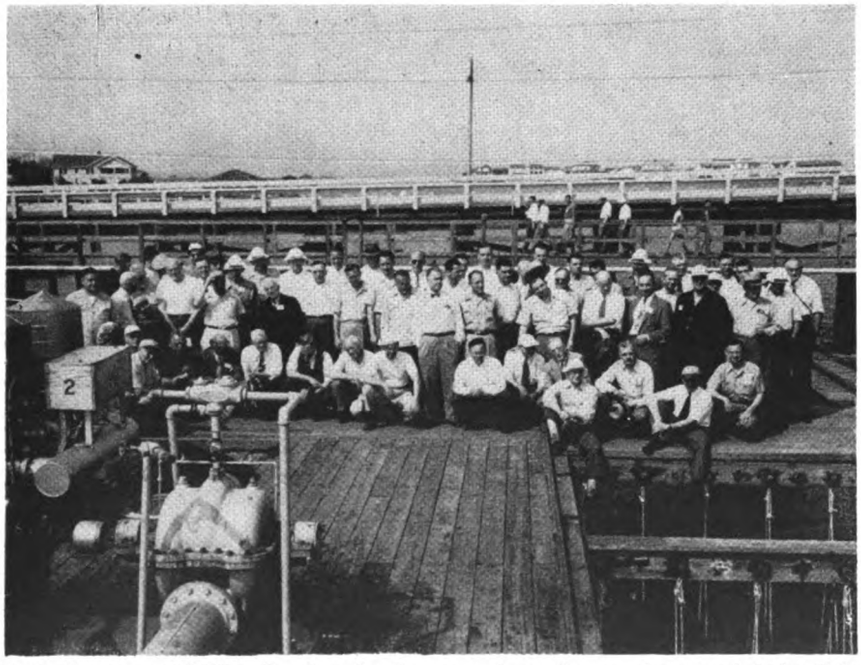
NOTES:

Canadian National.—The Canadian National's 1951 program calls for the purchase of 5,500 box cars (including 500 for the Grand Trunk Western), 500 refrigerator cars, and 2- 3,000-hp. diesel-electric road locomotives.

Northern Pacific.—The Northern Pacific will purchase seven 1,200-hp. switching, four 1,500-hp. road switching, one 1,500-hp. "B" freight and three 1,500-hp. passenger (two "A" and one "B") units, and two four-unit 6,000-hp. freight locomotives for 1952 delivery.

Pennsylvania.—The Pennsylvania shortly will order 132 additional diesel-electric locomotives, according to Walter S. Franklin, president of the road.

Union Pacific.—The Union Pacific will purchase 16 sleeping, 14 chair, 10 baggage, 6 dining, 2 mail-baggage and 2 baggage-dormitory cars.



Part of a group of 80 railroad and railway supply engineers who attended the Railroad Corrosion Conference sponsored by the International Nickel Company, Inc., at Wrightsville Beach, N. C. May 1 to 3, 1951. The program included discussions of corrosion problems on railroads, car design to resist corrosion (see page 43), corrsion problems associated with car cleaning, protective coatings, corrosion in diesel engines and gas turbine metals.

SUPPLY TRADE NOTES

AMERICAN BRAKE SHOE COMPANY.—*Raymond H. Schaefer* has been elected a vice-president of the American Brake Shoe Company, with headquarters at Mahwah, N. J.

◆

FRANKLIN RAILWAY SUPPLY COMPANY. *M. J. Donovan*, formerly assistant to the president of the Franklin Railway Supply company, has been appointed vice president, in charge of merchandising of new products, and *William T. Lane*, formerly western sales manager, has been appointed vice-president, in charge of western sales including the company's industrial products, with headquarters at Tulsa, Okla.

◆

AIR REDUCTION COMPANY.—*J. D. Gunther* has been elected a vice-president of the Air Reduction Company. Mr. Gunther has been secretary of the company since 1946.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*C. B. Peck*, editor of the Railway Mechanical and Electrical Engineer at New York, and *Edward G. Gavin*, editor of the American Builder at Chicago, have been elected directors of Simmons-Boardman. *William H. Schmidt, Jr.*, western editor of the Railway Age at Chicago, has been elected a vice-president and a director. *William L. Taylor*, circulation manager of the American Builder, has been appointed also circulation manager of the Railway Age, the Railway Mechanical and Electrical Engineer, Railway Engineering and Maintenance, and Railway Signaling and Communications, all Simmons-Boardman transportation publications. *Robert G. Lewis*, assistant to the president of Simmons-Boardman, has been appointed also director of subscription sales, transportation papers.

◆

ALUMINUM COMPANY OF AMERICA.—*Roy A. Hunt*, president of the Aluminum Company of America since 1928, has been named chairman of the Executive Committee, and *I. W. Wilson*, senior vice-president, has been elected president of the company. *J. O. Chesley*, manager of the railroad division of the company since 1944, has retired. No immediate successor will be named.

Mr. Wilson began his career with Alcoa in 1911 at Niagara Falls, N.Y., following his graduation from Massachusetts Institute of Technology. He became general superintendent of the aluminum company's reduction plants in 1921, and was named vice-president in charge of operations in 1931. He became senior vice-president in 1949. During World War I, Mr. Wilson

NEW--

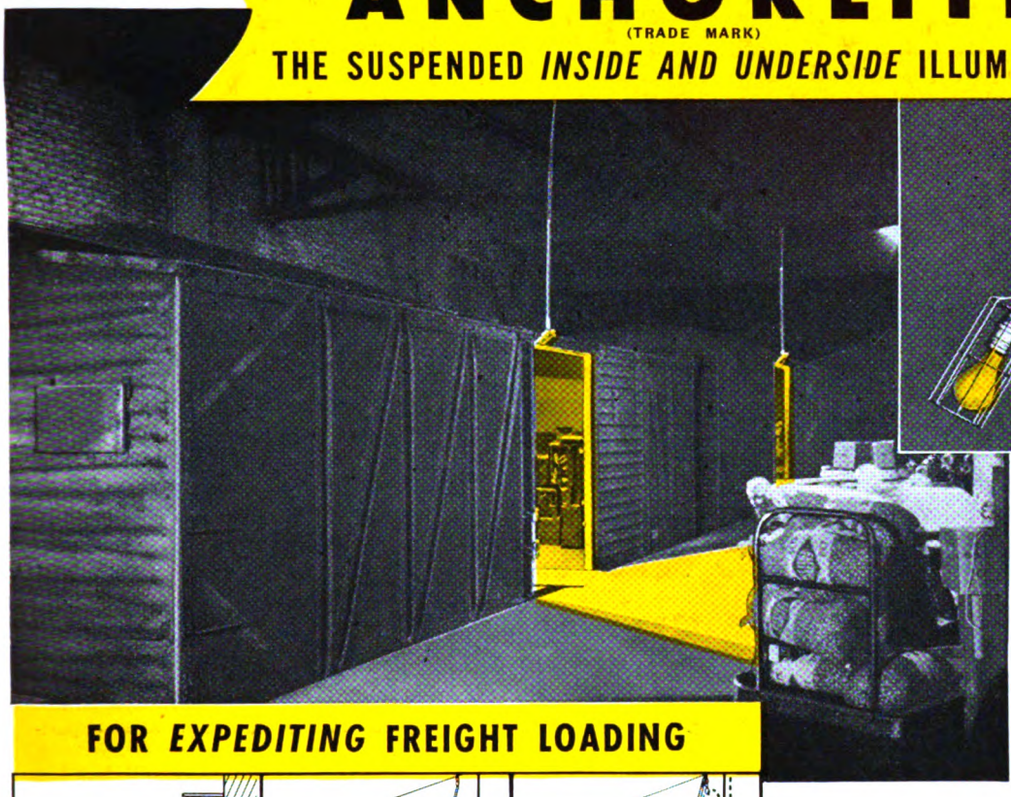
PYLE-NATIONAL

ANCHORLITE*

(TRADE MARK)

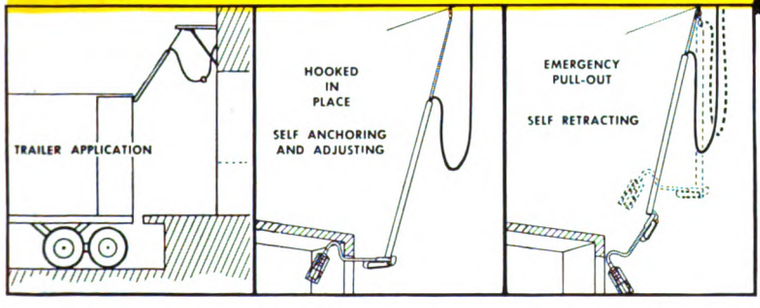
THE SUSPENDED *INSIDE AND UNDERSIDE* ILLUMINATOR





* Pat. No. 2,538,655. Other pats. pend.

FOR *EXPEDITING* FREIGHT LOADING



- *SAVES* MAN HOURS
- *REDUCES* MAINTENANCE AND REPLACEMENT COSTS
- *REDUCES* FIRE AND ACCIDENT HAZARDS

The Pyle-National ANCHORLITE answers the need for a convenient, economical source of the good lighting required, temporarily, *inside* freight cars, trucks and trailers while at loading platforms. It is also used to light the *underside* of equipment in locomotive and car shops and in warehouses and stock rooms for lower bin lighting.

The Pyle-Anchorlite is suspended overhead where it is out of the way yet always convenient and easy to reach when needed. In freight houses it is designed to be suspended from a messenger wire on which it can slide the full length of a loading platform bay, to any position where the freight car door may be spotted on the tracks. Spring tension anchors it in position for use without other means of holding and takes care of all variations in freight car door height.

Write for Anchorlite Bulletin

THE PYLE-NATIONAL COMPANY

1358 N. KOSTNER AVENUE CHICAGO 51, ILLINOIS

BRANCH OFFICES AND AGENTS in principal cities of the United States and Canada. EXPORT DEPARTMENT: International Railway Supply Co., 30 Church St., New York. CANADIAN AGENT: The Holden Co., Ltd., Montreal

SINCE 1897

LOCOMOTIVE HEADLIGHTS GYRALITES TURBO-GENERATORS FLOODLIGHTS PLUGS & RECEPTACLES MULTI-VENT AIR-DISTRIBUTION



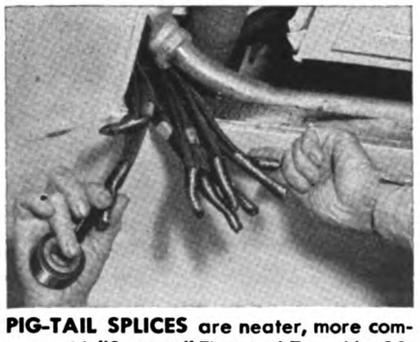
GREAT NORTHERN FINDS:

Plastic tape's tops when you're in a tight spot!

There's no room for bulky splices in the sleek walls of the Great Northern streamliners! That's why "SCOTCH" No. 33 Electrical Tape is used by Great Northern. Thin caliper and high dielectric strength make this the ideal single tape insulation.

And this same tape can do many jobs better for you. It's abrasion-resistant to withstand vibration, stretchy and smooth for neat harnesses, and it's unaffected by water, oil, sunlight. Sticks at a touch, too!

Order "SCOTCH" No. 33 Electrical Tape today from your jobber. Now available in "Job Size" ¾ in. x 20 ft. rolls packed 12 in a screwtop container. For complete information write: Minnesota Mining & Mfg. Co., Dept. RM-61, St. Paul 6, Minn.



PIG-TAIL SPLICES are neater, more compact with "SCOTCH" Electrical Tape No. 33. Tape has dielectric strength of 10,000 volts, replaces two conventional tapes with only a single application. Photos show car being wired at the St. Louis plant of the American Car & Foundry Company.



The term "Scotch" and the plaid design are registered trade-marks for the more than 100 Pressure-sensitive adhesive tapes made in U.S.A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minn. — also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minnesota Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Canadian Minnesota Mining & Mfg. Co., Ltd., London, Ont.

served in the Chemical Warfare Service, and attained the rank of Major. He headed Alcoa's $300,000,000 plant expansion program during World War II, as well as the $450,000,000 Defense Plant Corporation program carried out by Alcoa for the Government. In 1949 he received a Presidential Certificate of Merit in recognition of his contributions to the war effort.

Mr. Chesley is a graduate of Brown University (1911), with a bachelor of science degree in mechanical engineering. During the same year, he became a sales apprentice in the New Kensington, Pa., office of the Aluminum Company. In 1913 he was appointed manager of the district



J. O. Chesley

office in Detroit, and, two years later, was transferred to the Pittsburgh district sales office. He served in the United States Navy during World War I, and, when he returned to Alcoa, he was appointed mechanical engineer in the Pittsburgh sales department.

The Aluminum Company will build a new aluminum smelting plant at Wenatchee, Wash. The plant will be capable of supplying 170,000,000 pounds of aluminum annually; production is expected to begin within 15 months.

◆

READ STANDARD CORPORATION. — The *Standard Stoker Company* has changed its name to the Read Standard Corporation. No change in ownership, management or personnel has been made.

◆

ELECTRO-MOTIVE DIVISION. — A new diesel-repair parts warehouse to serve southwestern railroads has been established on Tillar street, Ft. Worth, Tex., by the Electro-Motive division of General Motors.

◆

AMERICAN WHEELABRATOR & EQUIPMENT CORP.—*Stanley F. Krzeszewski* has been elected a vice-president of American Wheelabrator. Mr. Krzeszewski will continue also as factory manager.

◆

DOUBLE SEAL RING COMPANY.—*M. A. Moore* has been appointed eastern division manufacturing and sales manager of the Double Seal Ring Company, Fort Worth, Tex. Mr. Moore, formerly sales and service representative in Maine, Vermont and

WHEN CRITICAL
MATERIAL IS SCARCE—
Repair POWER CABLES with
AMP SOLDERLESS
CONNECTORS



HEAVY DUTY PNEUMATIC TOOL #69015

Either "STUB" or conventional side position crimping with AMP's double-handled Pneumatic Tool. Interchangeable jaws for wire sizes #6 to #1/0.

SOLISTRAND® BUTT CONNECTORS



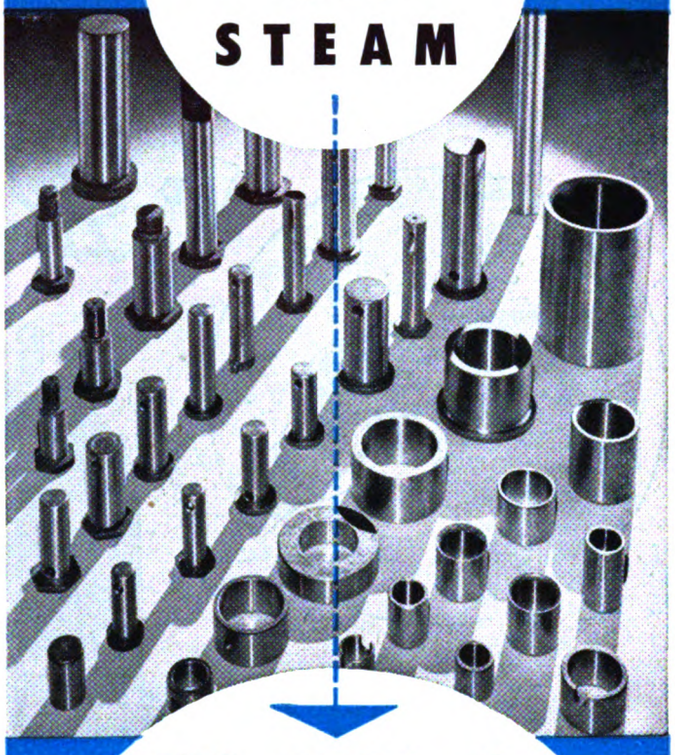
Can be used on solid, stranded or irregular shaped wire. These pure copper connectors make strong, vibration-proof permanent splices #22 to #4/0.

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AIRCRAFT-MARINE PRODUCTS, INC.
2100 Paxton Street, Harrisburg, Pa.

. . . for
DIESEL
and
STEAM



EX-CELL-O

RAILROAD PINS and BUSHINGS
WEAR LONGER

Diesel equipment brings new maintenance problems to America's railroads. Ex-Cell-O's methods of manufacturing railroad pins and bushings assure uniformity in size and quality that is essential to long service. The correct heat treatment gives an extremely hard surface for wear resistance and a tough ductile core to withstand shocks and vibration. Precision grinding assures a uniformly good finish and accurate size.

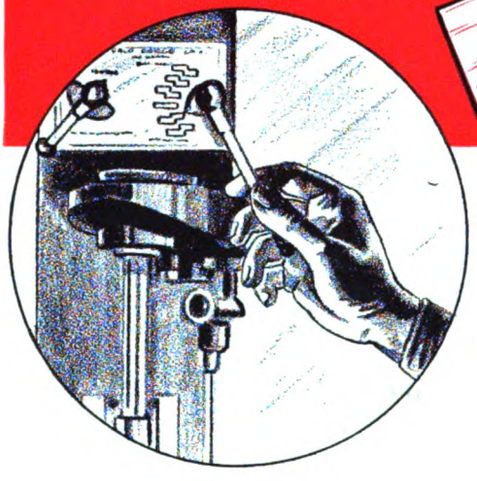
XLO
EX-CELL-O for PRECISION

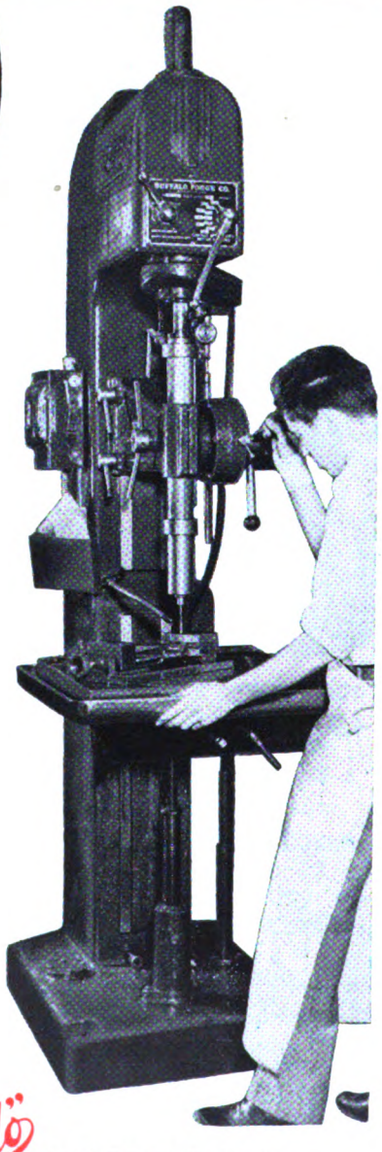


Whether your problems concern new work or maintenance on steam or Diesel equipment, it will be to your advantage to use Ex-Cell-O hardened and ground steel pins and bushings. Write today for a new catalog of standard types and sizes—ask for Bulletin No. 32381.

Railroad Division
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

The Speed You Need — INSTANTLY with the RPMSTER





No stopping the motor or other time-consuming adjustment — you select the proper speed for the job by moving a lever. The "Buffalo" RPMster's unique variable speed drive does the rest. Hundreds of these big 99"-high precision drills are saving money on both job and production work up to 1½" capacity in cast iron. BULLETIN 3257 has the specifications. LET US MAIL YOU A COPY.

BUFFALO "Buffalo" FORGE COMPANY

174 Mortimer St. Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

New Hampshire, will maintain new headquarters at New Rochelle, N. Y. Before joining Double Seal, Mr. Moore was a supervisor of diesel engine sales and service at Houston, Tex., for General Motors Corporation.

◆

EATON MANUFACTURING COMPANY.— *R. B. Little* has been appointed general sales manager of the Reliance division of the Eaton Manufacturing Company.

Mr. Little attended the Republic Steel sales school, Massillon, Ohio, in 1932 and

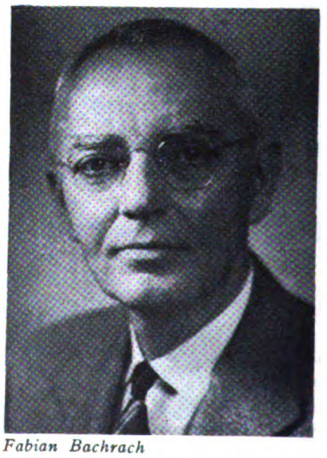


R. B. Little

subsequently worked for five years as a member of the sales department in the New York office. In 1939 he joined the Moltrup Steel Products Company, Beaver Falls, Pa., as sales manager in charge of the New York district territory. He joined Eaton as a sales representative in the Reliance division's New York sales office.

◆

BLACK & DECKER MFG. CO.— *Alonzo G. Decker*, a cofounder of Black & Decker, has been elected president to succeed S. Duncan Black, deceased. *Robert D. Black*, vice-president in charge of sales, has been elected vice-president, and *Glen H. Treslar*, vice-president and sales manager, has been elect-



Fabian Bachrach

A. G. Decker

ed vice-president in charge of sales.

Mr. Decker, who has been vice-president and general manager of the company since he and S. Duncan Black started the company in 1910, began to work at the age of 15 in a brass foundry as an apprentice

LESS SLIP... LESS NOISE... LESS MAINTENANCE

QUAKER V-BELTS

Built to Harness Railway Industry's Horsepower!

Year after year at work on railway equipment and in countless applications Quaker V-Belts continue to pile up records for low cost performance.

That's because Quaker V-Belts are built to:

- Deliver power more efficiently.
- Eliminate slippage and vibration.
- Require less maintenance and adjustment.
- Withstand punishment.

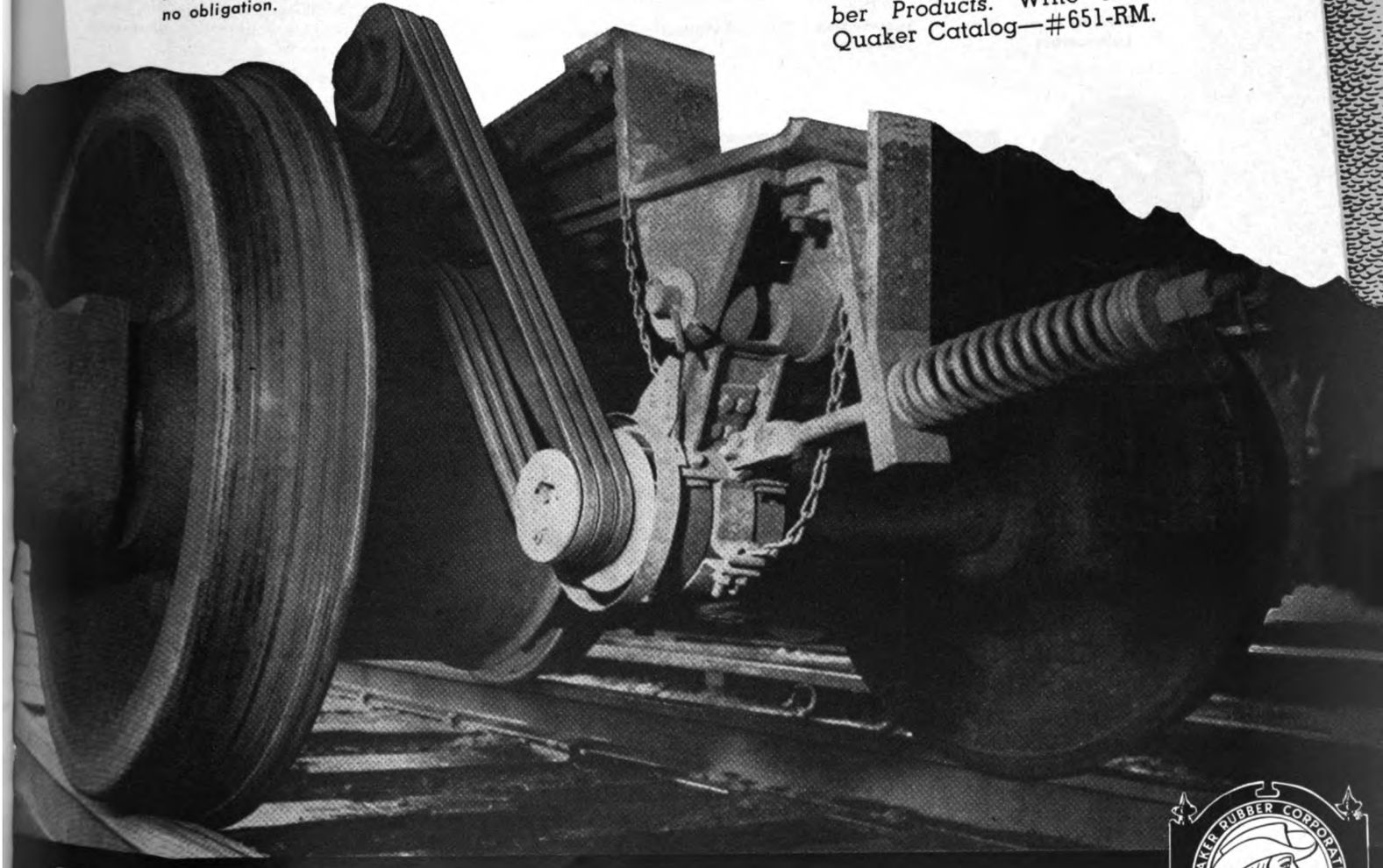
Quaker's technical skill, research and developments are behind the extra efficiency and stamina of Quaker V-Belts. Longer-than-average wear of these belts results from a construction of specially compounded materials . . . husky, pre-stretched cords . . . tough, rugged covers.

The work-horse ability of Quaker V-Belts characterizes all of Quaker's pre-tested, performance proved products. *That is why you should specify Quaker Industrial Rubber Products.* Write for the new Quaker Catalog—#651-RM.



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. . . and the entire QUAKER Conservation Maintenance Plan — includes maintenance memos, wall chart, factual data to help you reduce maintenance. No charge . . . no obligation.



QUAKER RUBBER CORPORATION
DIVISION OF H. K. PORTER COMPANY, INC.
PHILADELPHIA 24, PENNA. BRANCHES IN PRINCIPAL CITIES

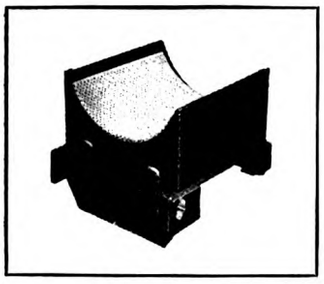
QUAKER RUBBER CORPORATION · PHILADELPHIA, PA. · QUALITY SINCE 1885
REG U S PAT OFF

use Franklin parts on Franklin devices

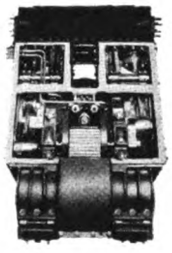


Sleeve Joints

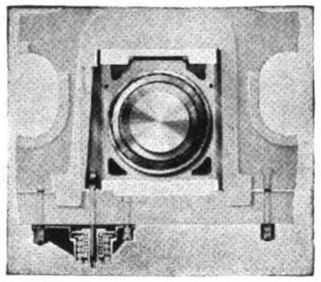
In order to obtain full efficiency from your Franklin devices, specify genuine Franklin parts in replacement. Franklin devices will always perform best when equipped with genuine Franklin parts made to interchangeable tolerances and of the correct materials.



Driving Box Lubricators



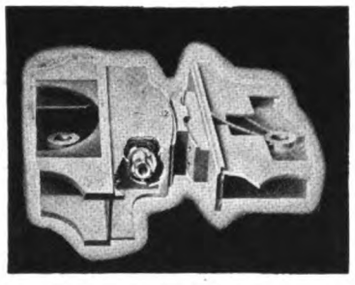
The Locomotive Booster



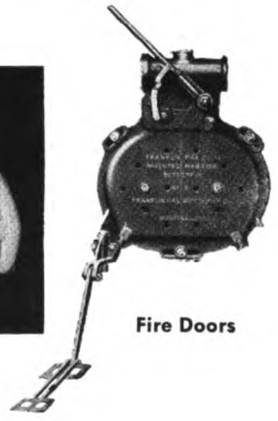
Automatic Compensators & Snubbers



Franklin System of Steam Distribution



Radial Buffers



Fire Doors



Power Reverse Gears

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM · BOOSTER · RADIAL BUFFER · COMPENSATOR AND SNUBBER
POWER REVERSE GEARS · FIRE DOORS · DRIVING BOX LUBRICATORS · OVERFIRE JETS
JOURNAL BOXES · FLEXIBLE JOINTS · TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

moulder. He later worked in a pattern shop and, finally, in the shop of the National Composotype Company where he advanced to the engineering department. In 1906 he joined the engineering department of the Rowland Telegraphic Company. Four years later he and Mr. Black went into business together making special machinery to order.

◆

PEERLESS EQUIPMENT COMPANY.—*Norman T. Olsen* has been elected vice-president of the Peerless Equipment Company.

◆

GENERAL ELECTRIC COMPANY.—*Arthur H. Morey*, project engineer of the Locomotive and Car Equipment divisions of the General Electric Company, recently was awarded a Charles A. Coffin award, the company's highest honor, for his "vision, ingenuity, and perseverance in designing, developing and testing the first gas turbine electric locomotive to be built in the United States."

◆

ELECTRIC STORAGE BATTERY COMPANY.—The Electric Storage Battery Company has announced plans for a new three-story building, 52 ft. wide by 421 ft. long, at Crescentville, Philadelphia, Pa., for its engineering department. The building, of steel, brick and concrete, will provide 40,000 sq. ft. of working area and will house a museum of Exide products; a new technical library, and laboratories with the research equipment for spectrographic, photomicrographic and X-Ray diffraction stud-

◆

UNION ASBESTOS & RUBBER CO. The Union Asbestos & Rubber Co. has acquired the business of *Dromgold & Glenn*, Chicago, suppliers of refrigeration equipment for refrigerator cars, trucks and tailers. Henceforth the business will be operated as the *Dromgold & Glenn Division* of Union Asbestos & Rubber, under the direction of *W. H. Fehrs*, vice-president of the latter company.

◆

FAIRBANKS, MORSE & CO.—A new sales and service office has been completed by Fairbanks, Morse at 3000 West 117th street, Cleveland, Ohio. The new structure, with an area of about 30,000 sq. ft., includes the Cleveland branch office, a modern diesel repair shop, completely equipped scale shop for repairing and rebuilding scales, a large warehouse, and repair parts department and display floor.

◆

UNION CARBIDE & CARBON CORP.—*Dr. George O. Curme, Jr.*, has been elected vice-president in charge of research of the Union Carbide & Carbon, Corp. Dr. Curme, who has been vice-president in charge of chemical research for the corporation, will now head all of the research activities of Union Carbide.

◆

STANDARD CAR TRUCK COMPANY.—*Dan Call* has been appointed sales agent for the Standard Car Truck Company, with headquarters at Richmond, Va.

Frank Nugent has been appointed sales

a 10-year record of improved values

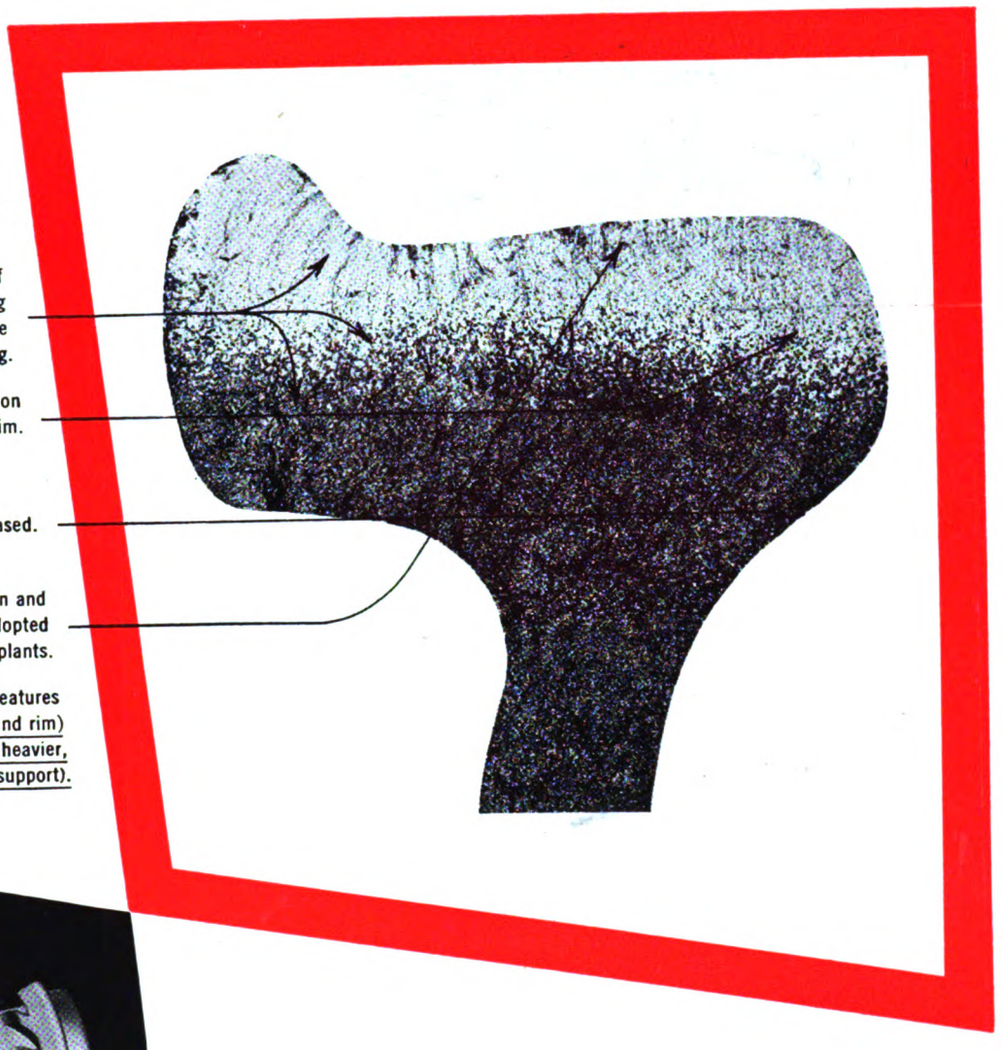
1941-1946 Improved Control of mottled iron formation, providing clearer chill at tread and more impact resistant gray iron backing.

1945 AMCCW plants adopt limitation on chill depth in rim.

1945 Rim thickness increased.

1947 More rigid inspection and standards for rotundity adopted for wheels shipped from AMCCW plants.

1950 New wheel design features heavier tread (stronger flange and rim) and more brackets (thicker, heavier, more continuous flange support).





INSIDE STORY...

of the AMCCW chilled car wheel

The 10-year record of improved values gives you the inside story of why AMCCW wheels are making better safety records . . . 120,000,000 car miles in 1950 without failure.

(And the new AMCCW design with its 100% increase in rim strength and 20% increase in flange strength is just beginning to roll.)

The record shows why chilled car wheel performance has improved so continuously, over the years.

For more information about the advantages of AMCCW wheels, write for the booklet: GENTLEMEN OF THE JURY.

Low first cost
Low exchange rates
Reduced inventory
Short haul delivery
Increased ton mileage
High safety standards
Complete AMCCW inspection
Easier shop handling

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

445 North Sacramento Boulevard, Chicago 12, Ill.

American Car & Foundry Co. • Southern Wheel (American Brake Shoe Co.)
Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co.



agent, with headquarters at St. Paul, Minn. Mr. Call was formerly associated with the Richmond, Fredericksburg & Potomac for 20 years and was general foreman of the locomotive department when he left that road in 1948 to enter private business.

◆

TIMKEN ROLLER BEARING COMPANY.—*Paul Reeves*, formerly advertising manager of the Timken Roller Bearing Company, has been appointed director of sales.

Mr. Reeves joined Timken in 1929 and, after completing his engineering training course, worked as sales engineer in the Chicago office. He subsequently was transferred to the San Francisco, Cal., branch office where he was appointed industrial district manager. In 1940 he was appointed sales promotion manager, with headquarters at Canton, Ohio, and during World War II was in charge of handling contracts between the company and the government. Mr. Reeves was appointed advertising manager in 1943.

◆

SPRING PACKING CORPORATION.—*John B. Welch* and *W. Huntley McPhee* have been appointed assistant vice-presidents and *Carl A. Schroeder* and *Lee C. Van Hooser* regional managers of the Spring Packing Corporation, with headquarters at New York and Los Angeles, Cal., respectively.

◆

SCULLIN STEEL COMPANY.—*Fred H. Spenner*, formerly vice-president in charge of mechanical engineering of the Scullin Steel Company, St. Louis, Mo., has been appointed vice-president and executive assistant to the president.

◆

BALDWIN-LIMA-HAMILTON CORPORATION.—*Thomas F. Kearney*, formerly diesel service supervisor for Baldwin-Lima-Hamilton at Chicago, has been appointed transportation sales representative for the Chicago district. *James M. Barnhill* succeeds Mr. Kearney as diesel service supervisor.

Obituary

S. DUNCAN BLACK, president of the Black & Decker Mfg. Co., died suddenly on April 15 of a cerebral hemorrhage in Bal-



Fabian Bachrach

S. D. Black

ERIE service hits new high at 100-year mark with help of TIMKEN® bearings



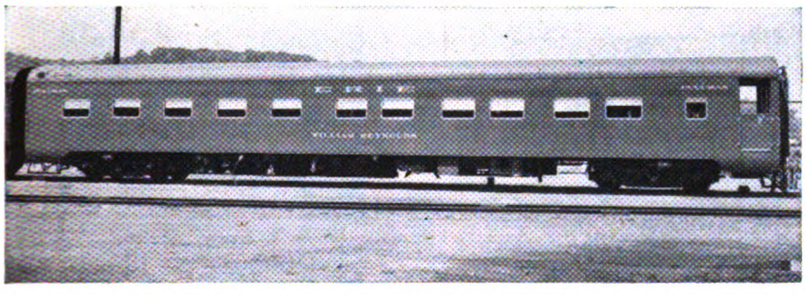
1. THE YEARS leading up to the Erie Railroad's 100th Anniversary, now being celebrated, have been marked by continuous progress—resulting in constantly better service for Erie shippers and passengers.



2. IMPORTANT STEP in Erie progress has been the use of Timken® tapered roller bearings on many types of Erie equipment. The Erie's new Alco passenger diesels on the Cleveland-Pittsburgh run are Timken bearing equipped.



3. ERIE DINING CARS, too, roll on Timken tapered roller bearings. Passengers like the smooth, jolt-free rides that Timken roller bearings make possible; Erie operating people like the low maintenance costs.



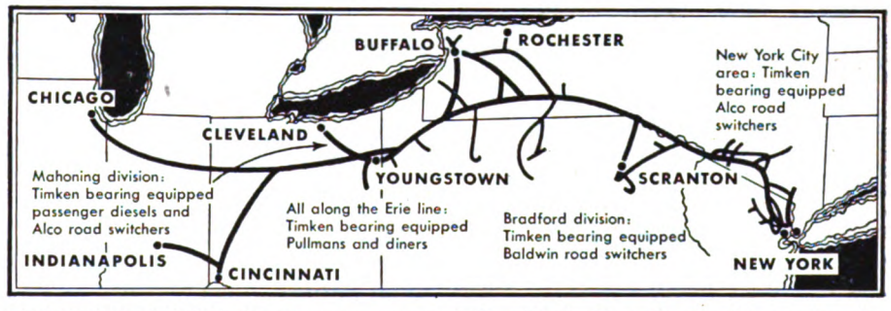
4. DELUXE IN EVERY WAY, the Erie Railroad's luxurious new "President" series of pullmans is Timken bearing equipped, insuring maximum riding comfort.



5. SPEEDING FREIGHT on the Bradford Division, Erie's Baldwin road switchers roll on Timken bearings.



6. THE ERIE'S Alco road switchers are also on Timken bearings, eliminating the possibility of delays due to bearing trouble.



7. THE ERIE SERVES the six great states of New York, New Jersey, Pennsylvania, Ohio, Indiana and Illinois—the Heart of Industrial America. Throughout the Erie system (see map above), Timken tapered roller bearings are helping the Erie set ever-higher standards in transportation service.

More steam locomotives, passenger cars, and freight cars roll on Timken bearings than on any other make of anti-friction bearings. Let us help you with your bearing applications. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL AND THRUST ↔ LOADS OR ANY COMBINATION



Lord Mountings cushion road shock, reduce noise, protect the smooth functioning of equipment, reduce maintenance costs, add to the comfort and satisfaction of the traveling public.

When you plan new locomotives, new passenger cars, new auxiliary equipment be sure that Lord Mountings are in the drawings and the specifications . . . make them a part of design. No other expenditure you can make will bring as great returns from so small an outlay. Here are some of the places where Lord Mountings will serve you profitably:

- **Relay Panelboards**
- **Wheel-driven Generators**
- **Fans**
- **Vestibule Diaphragms**
- **Air Conditioning Units**
- **Power-driven Generators**
- **Signal Equipment**
- **Communication Equipment**

Write for your copy of the Lord Natural Frequency Chart and of the Vibration Isolation Chart. Designers and engineers will find them of definite value.

Although defense production is putting a heavy demand on our facilities, LORD will make every effort to supply industrial needs.

LORD MANUFACTURING COMPANY • ERIE, PA.

Canadian Representative, Railway & Power Engineering Corp. Ltd.

LORD BONDED RUBBER — *Vibration-Control Mountings . . . Bonded-Rubber Parts*

timore, Md. Cofounder of the firm with Alonzo G. Decker 40 years ago, Mr. Black had continued as the active head of the company until his death. He was 67 years old.

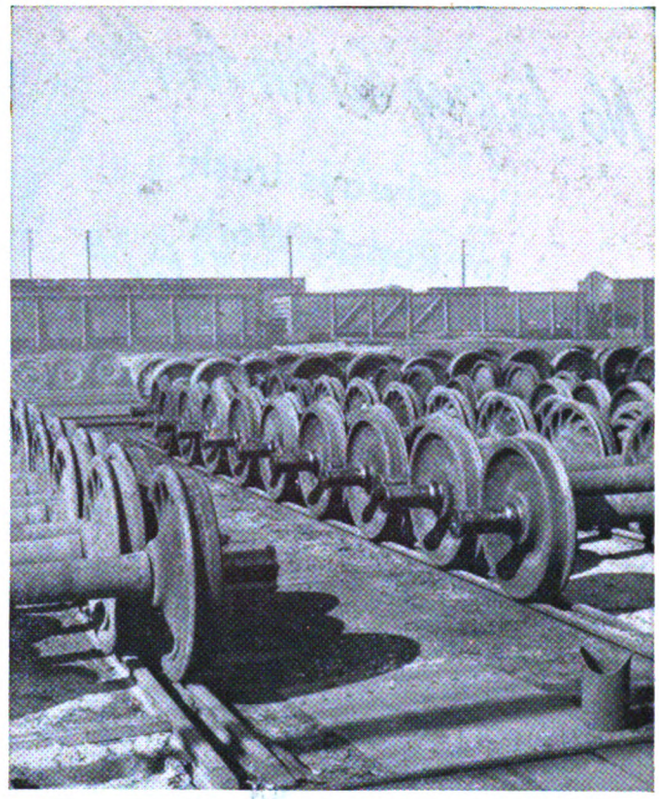
FRANK P. ROESCH, retired vice-president of the Standard Stoker Company, died at his home in Chicago on April 28 at the age of 87. Mr. Roesch was born in Alsace-Lorraine, on April 14, 1864. He attended grammar and high schools and in 1877 became a machinist apprentice on the Chicago, Rock Island & Pacific at Trenton, Mo. In 1881 he became a machinist in the employ of the South Park Railway (now the Colorado & Southern) at Denver, Colo. and in 1883, enginehouse foreman at Gunnison, Colo. From later in the same year through part of 1884 he was, successively, boomer machinist, locomotive fireman and locomotive engineer with the Denver & Rio Grande (now the Denver & Rio Grande Western), the Southern Pacific and the Atlantic & Pacific (now the Atchison, Topeka & Santa



F. P. Roesch

Fe). He then became division foreman on the A. & P. at Winslow, Ariz., and in 1885 general foreman on the Florida & Peninsula (now the Florida East Coast) at Fernandina, Fla. In 1886 he went with the Denver & New Orleans (now the Colorado & Southern) as enginehouse foreman at Denver. In 1887 he became locomotive engineer; in 1891, traveling engineer; in 1892, locomotive engineer; in 1899, general traveling engineer, and in 1901, master mechanic of the C. & S. In 1902 he was appointed master mechanic of the Chicago & Alton (now the Gulf, Mobile & Ohio), and in 1904, general manager of the Hicks Locomotive & Car Works, Chicago. In 1906 he became master mechanic of the Southern, serving successively at Birmingham, Ala., and Spencer, N.C. He was master mechanic of the El Paso & Southwestern (now the Southern Pacific) at Douglas, Ariz., from 1908 until 1918, when he was appointed regional fuel supervisor, Northwest Region, United States Railroad Administration. His association with the Standard Stoker Company became in 1920 as western manager. In 1923 he was appointed general sales manager and in 1935 was elected vice-president and director. Mr. Roesch was an affiliate member of the Mechanical Division, A.A.R.; a past presi-





on cars . . . on car journals . . . NO-OX-ID will

stop rust before it starts

Losses due to corrosion, costly unnecessary repairs can ill be afforded during these critical days. To help you maintain and protect your vital equipment, Dearborn provides a complete line of NO-OX-ID rust preventives for positive protection against the constant threat of corrosion. Two examples of the effective use of NO-OX-IDs are:

1. ***ON GONDOLA CAR*** construction. Wherever there is metal-to-metal contact, NO-OX-ID Filler Red "C" prevents corrosion, greatly reduces maintenance costs.
2. ***CAR JOURNALS*** must be protected during storage, ready for use when needed. A single coat of NO-OX-ID "A Special" is all that's needed to protect them for extended periods of outdoor storage.

Let a Dearborn engineer help you develop a NO-OX-ID preventive maintenance program. He will demonstrate how proper application of the correct NO-OX-ID will stop corrosion.

Please Note Our New Address

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

SEND THE COUPON FOR INFORMATIVE NO-OX-ID BULLETINS

A series of bulletins on rust prevention in the railroad industry is available to you. These bulletins will show you how you can benefit by the correct NO-OX-IDs and will aid you in their selection. Mail the coupon.

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. RM
Chicago 54, Illinois

Gentlemen:

( ) Please send me bulletins on NO-OX-ID for the railroad industry.

( ) Have a Dearborn engineer call.

Name.....

Company.....

Address.....

City.....*State*.....

Dearborn
Reg. U. S. Pat. Off.

NO-OX-ID
IRON + OX = RUST

THE ORIGINAL RUST PREVENTIVE

No Jacking Strain for Me!

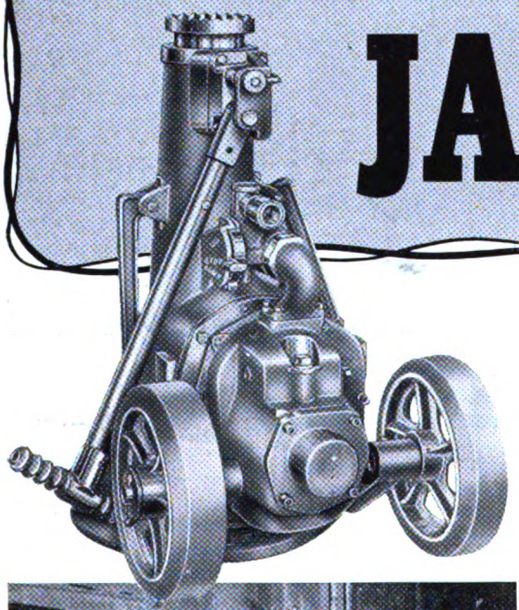
I'm always fresh for Repair Work with

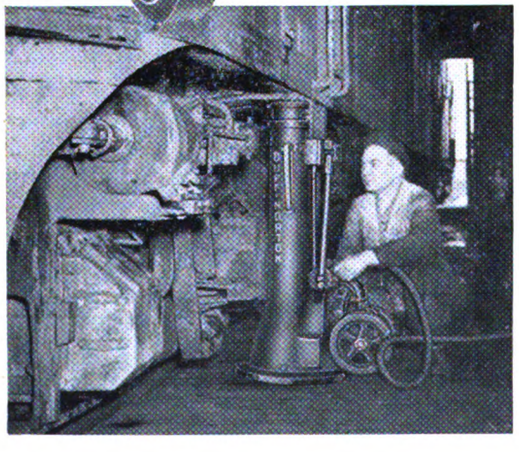


DUFF-NORTON

AIR MOTOR POWER

JACKS





Railroad men appreciate the relief from jacking strain made possible by Duff-Norton Air Motor Power Jacks, in lifting all types of locomotives and cars for repair and maintenance work. Another thing—men are kept fresh to begin repairs as soon as heavy load is lifted, since the only effort used in the jacking operation is a flip of the finger.

These jacks are available with lifting capacities from 20 to 100 tons. They can be controlled to a fraction of an inch and are easy to spot—easy to handle. No danger of creepage or sinking under load.

Write today for Bulletin AD-11R.

STRENGTH SAFETY DURABILITY
DUFF-NORTON JACKS
ESTABLISHED 1883

THE **DUFF-NORTON** MANUFACTURING CO.

MAIN PLANT and GENERAL OFFICES, PITTSBURGH 30, PA.—CANADIAN PLANT, TORONTO 6, ONT.

"The House that Jacks Built"

dent of the Traveling Engineers' Association, and a past president of the Railway Eqipment Supply Men's Association. He was a member of the American Society of Mechanical Engineers, the Railway Fuel & Traveling Engineers' Association, the Smoke Prevention Association and the Master Boiler Makers' Association, and was chairman of the Committee of the Coordinated Mechanical Associations.

PERSONAL MENTION

General

H. M. HOFFMEISTER has been appointed engineer of tests of the Missouri Pacific Lines, with headquarters at St. Louis, Mo..

P. J. FINCH has been appointed assistant to superintendent motive power—diesel engineering and maintenance, of the Chesapeake & Ohio at Richmond, Va. The position of mechanical engineer at Richmond, formerly held by Mr. Finch, has been abolished.

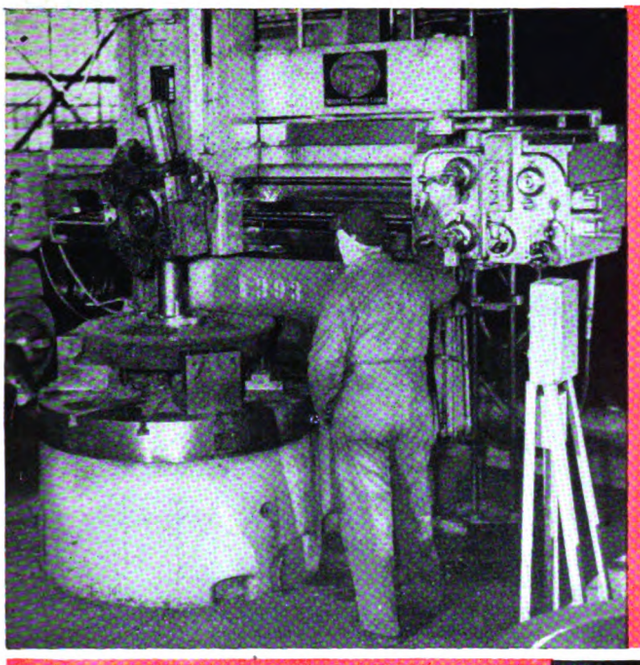
L. H. KUECK, assistant chief mechanical officer of the Missouri Pacific Lines, at St. Louis, Mo., has retired. Mr. Kueck was born at Sedalia, Mo., July 20, 1895, and



L. H. Kueck

entered railroad service in April, 1917, with the M. P. as a draftsman. From 1920 to 1924 he was a draftsman on the Texas & Pacific, subsequently returning to the M. P. Later he advanced through the positions of chief draftsman, assistant chief mechanical engineer and chief mechanical engineer, becoming assistant chief mechanical officer in February, 1944.

E. C. MEINHOLTZ, engineer of tests of the Missouri Pacific Lines at St. Louis, Mo., has been appointed mechanical engineer, with headquarters at St. Louis. Mr. Meinholtz was born at St. Louis, May 14, 1904, and educated in the public schools there and at Washington University, where he received bachelor and master of science degrees in mechanical engineering. He began his career with the M. P. in the summers of



MAN-AU-TROL

VERTICAL
TURRET LATHES

MANUAL OR AUTOMATIC

Operation For
Short Run Jobs
or the Longer
Production Runs.

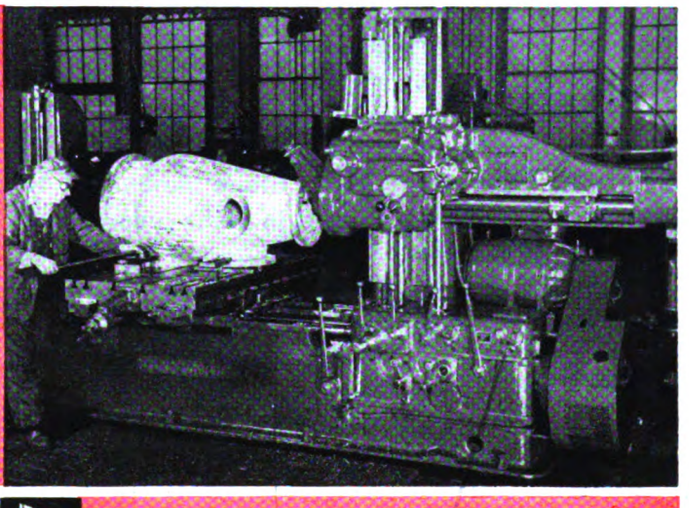
BULLARD

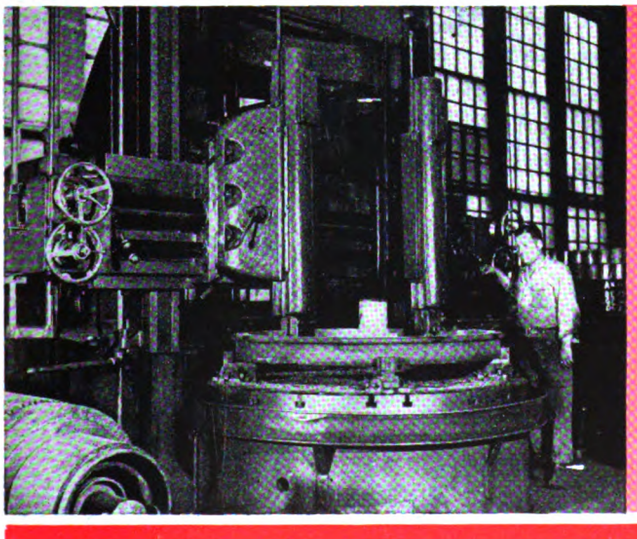
Universal

FOR

HORIZONTAL BORING MILL JOBS

Performance
Plus Utility





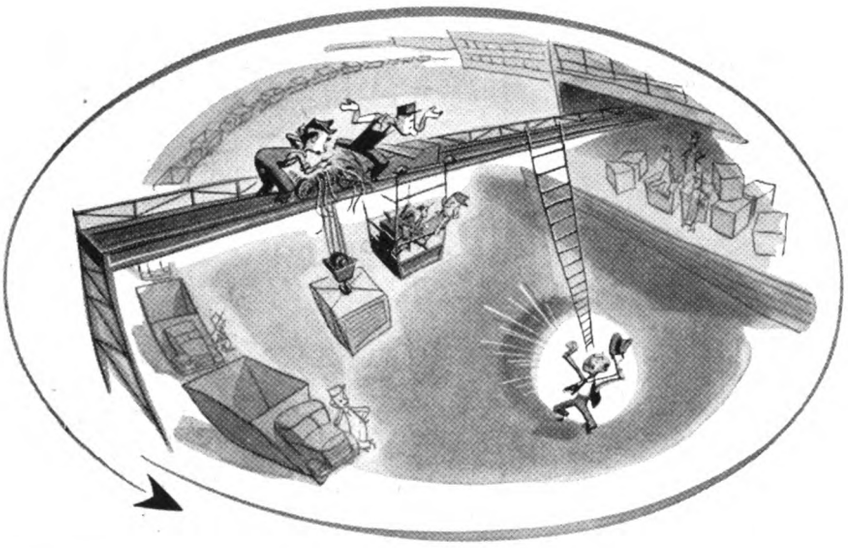
CUT MASTER

VERTICAL
TURRET LATHES
IN 6 SIZES
30 INCH TO 74 INCH

Assured Accuracy and a Plus in manufacturing Economy. Simultaneous cutting with three heads.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT



Burned-out Motors Waste Manpower!

Men without motors are just about as helpless in a modern factory as a wagon without wheels on a superhighway.

In many plants the failure of a single motor used to drive an overhead crane or a conveyor system can cost thousands of dollars an hour in lost production and wasted man-hours of labor.

The answer is Class H insulation made with Dow Corning Silicones. In a steel mill, for example, a cupola crane hoist motor insulated with the best Class B materials had an average life of only 50 days. Rewind costs alone amounted to $3,634 in three years. That motor, rewound with Class H Insulation at an extra cost of only $79 was still in good condition after 613 days on the hoist and 908 days on the trolley bridge.

And Class H is readily available. Most of the best rewind shops now feature this longer lasting, more reliable class of insulation. Leading motor manufacturers are quoting price and delivery on new Class H machines.

Dow Corning Silicones Mean Business!

MAIL THIS COUPON TODAY!

DOW CORNING CORPORATION, MIDLAND, MICHIGAN

Please send me ☐ More Evidence ☐ List of Class H Rewind Shops ☐ List of Motor Manufacturers Offering New Class H machines. S-6

Name_____

Company_____

Street_____

City_____ Zone____ State____

DOW CORNING SILICONES

DOW CORNING CORPORATION

BRANCH OFFICES: ATLANTA • CHICAGO • CLEVELAND • DALLAS • LOS ANGELES NEW YORK • WASHINGTON, D. C. • In CANADA: Fiberglas Canada Ltd., Toronto In GREAT BRITAIN: Midland Silicones Ltd., London.

1924 and 1925 as a machinist helper. He was employed by the Scullin Steel Company from August, 1926, to May 1927, when he joined the M.P.'s test and inspection department as assistant chemist. Subsequently Mr. Meinholtz held various positions and in 1939 became assistant engineer of tests. From November, 1942, to October, 1945, he was on leave from the road serving with the U. S. Army as captain. When he returned to the M.P. in November, 1945, he continued as assistant engineer of tests. He was appointed engineer of tests in August, 1946.

L. R. SCHUSTER, engineer, car construction, of the Southern Pacific, at San Francisco, Cal., has retired. Mr. Schuster was born at Napa City, Cal., March 12, 1883,



L. R. Schuster

and studied mechanical engineering through a correspondence school course. He started his career in December, 1901, in the passenger car department of the S. P. at Sacramento, Cal., later holding the positions of draftsman; assistant chief car draftsman and chief car draftsman before being appointed engineer, car construction in 1940.

W. W. MATZKE, assistant to chief mechanical officer of the Chicago & North Western, has been appointed to chief mechanical engineer.

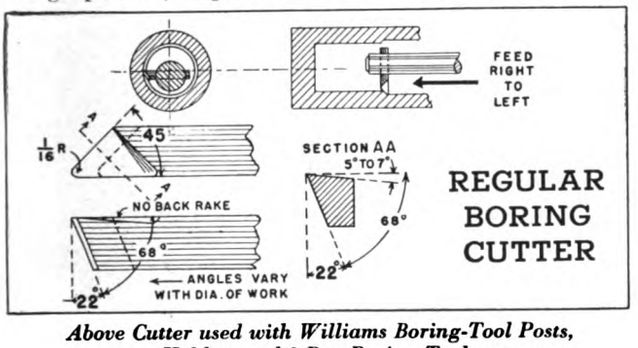
W. P. MILLER, superintendent diesel and motor car equipment, of the Chicago & North Western at Chicago has been appointed assistant to chief mechanical engineer at Chicago.

E. H. WESTON, mechanical engineer of the Chicago & North Western at Chicago has been appointed assistant chief mechanical engineer.

NORMAN A. PASSUR, supervisor, car construction, of the Southern Pacific, has been appointed engineer, car construction, with headquarters at San Francisco, Cal. Mr. Passur entered the service of the S. P. in April, 1919, as a junior draftsman, and later became draftsman. He was appointed air-conditioning engineer at San Francisco in 1936, and in 1939 was transferred to Chi-

Memo to mechanics — How to do it right with WILLIAMS BORING TOOLS

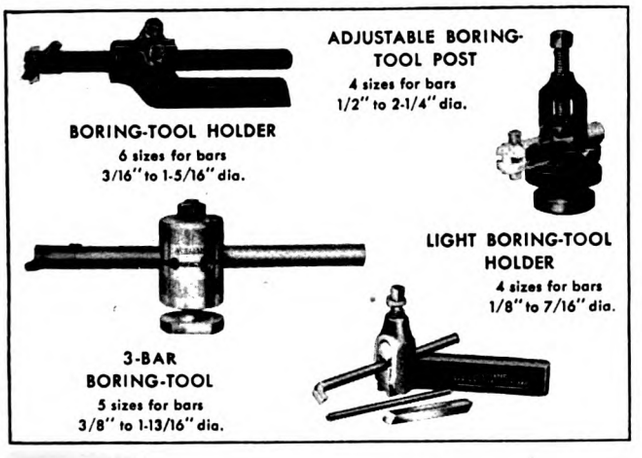
Boring Tools of this type, as opposed to drills and reamers, are used for machining internal surfaces and their operation might be described as *inside* turning. The cutters differ from outside turning tools in that they must be ground with more front clearance to prevent the heel of the tool from rubbing. Recommended grinding angles and proper application of tools to work are graphically explained in the three diagrams.

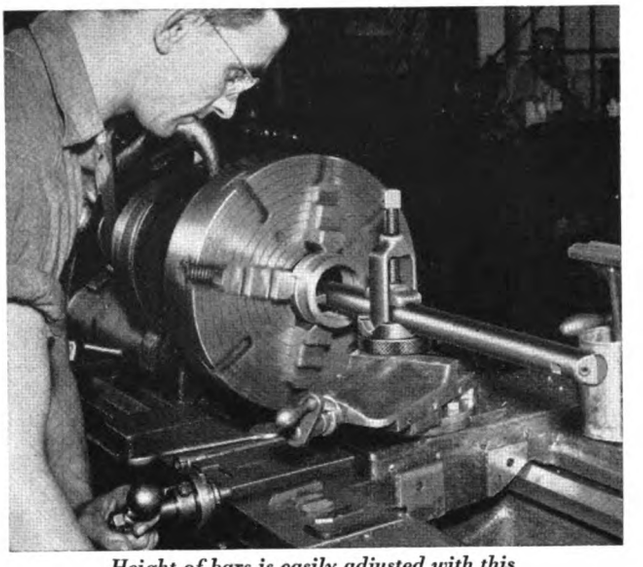


Above Cutter used with Williams Boring-Tool Posts, Holders and 3-Bar Boring-Tools

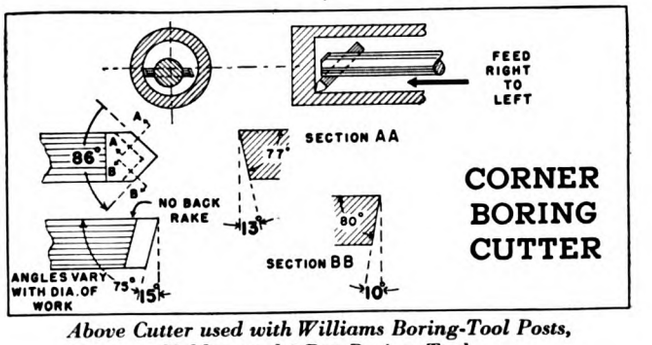
There are four types of Williams Boring Tools as illustrated below. Bars and Cutters are interchangeable in all except the Light Boring-Tool Holder. Depth of hole, of course, determines the length of bar required. When using long bars, remember that the increased overhang makes the tool more likely to spring and correspondingly lighter cuts should be taken.

Copies of this and other "Memos to Mechanics" are available free upon request.

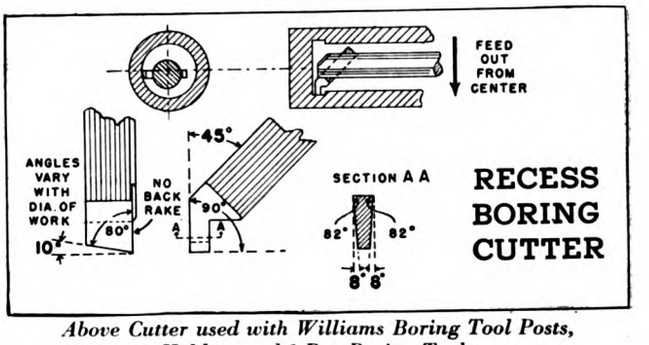




Height of bars is easily adjusted with this Williams Boring-Tool Post



Above Cutter used with Williams Boring-Tool Posts, Holders and 3-Bar Boring-Tools



Above Cutter used with Williams Boring Tool Posts, Holders and 3-Bar Boring-Tools

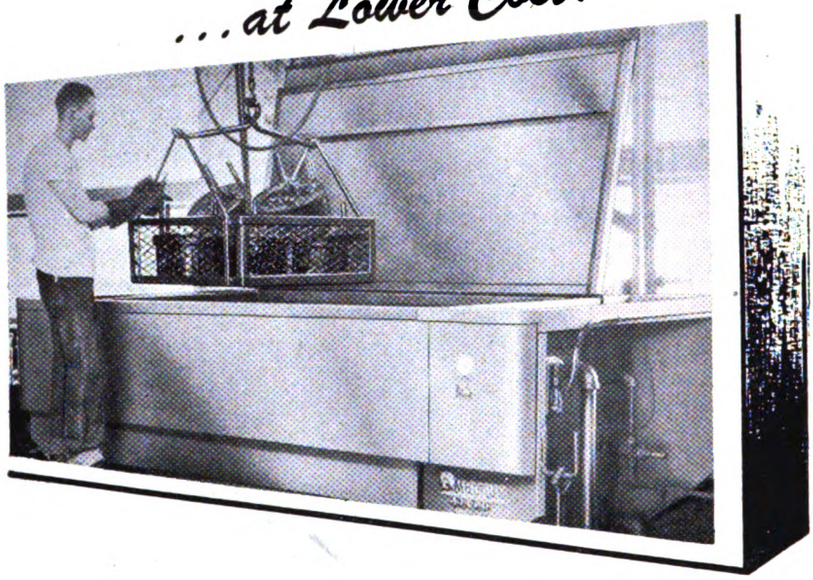
OPEN END, BOX, ADJUSTABLE & RATCHET WRENCHES; DETACHABLE SOCKETS & SETS; IMPACT SOCKETS; TOOL HOLDERS; LATHE DOGS; "C" CLAMPS; CHAIN PIPE TONGS & VISES; FLANGE JACKS; PLIERS; SCREWDRIVERS; PUNCHES & CHISELS; SOFT FACED HAMMERS; HOIST HOOKS; EYE BOLTS; ROD ENDS; CRANK & BALANCE HANDLES; THUMB SCREWS & NUTS; BODY & FENDER TOOLS.

WILLIAMS
• OUR DISTRIBUTOR IS YOUR LOCAL WAREHOUSE

J. H. WILLIAMS & CO., BUFFALO 7, N. Y. *Distributors Everywhere*

Mechanical Agitation Gives You Cleaner Parts Faster

...at Lower Cost!



Get the vastly improved results of the *mechanical* cleaning provided by Magnus Aja-Dip Machines. While the cleaning solution is softening soil deposits, the *work itself* is moved up and down in the solution many times a minute, so that there is a vigorous flushing and shearing effect on all the dirt deposits, especially in interior areas not readily reached by plain soaking or ordinary agitation.

ON DIESEL PARTS

Magnus Aja-Dip Cleaning Machines insure strikingly large savings in time over all other methods of cleaning. For example, you can clean heads in 1½ hours, liners in 2 hours, rods, pistons and blowers in 20 minutes, and other parts in from 5 to 15 minutes. And clean them far better, with virtually no hand work! These machines are in use today by roads constituting over 60% of the diesel horsepower on railroad work.

ON AIR FILTERS

More and more roads are turning to the Aja-Dip Machine for cleaning air filters. The standard unit for this purpose will clean 36 small filters (9"x 20"x 2¼") or 18 large filters (20"x 22"x 2¼") in *two minutes*. Spick and span clean, through and through, ready for drying and oiling

Write for complete details on the kind of economies in time you can obtain with Aja-Dip Cleaning Machines.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

cago to help supervise construction of the S.P.'s second pair of "Daylights." After service in the Military Railway Service, first as captain and later as major, from 1943 to 1946, Mr. Passur returned to the S. P. as assistant engineer, car construction. He became supervisor, car construction, in 1948.

PHILIP H. HATCH, who has retired as general mechanical superintendent of the New York, New Haven & Hartford at New Haven, Conn., as announced in the May issue, was born in Albany, N.Y., on May 25, 1899, and attended Massachusetts In-



Phillip H. Hatch

stitute of Technology (BS. 1921). He was a student engineer with General Electric Company at Schenectady, N.Y., during 1921-1922; entered railroad service in 1922 as computer with the Cleveland Union Terminals at Cleveland, Ohio, and joined the New Haven in 1923, serving successively as special apprentice, electrical inspector, engineering assistant, engineer automotive equipment, assistant engineer and engineer electric and automotive equipment. He was appointed assistant mechanical engineer in 1941, mechanical engineer in May, 1944, and general mechanical superintendent in November, 1944.

H. S. MCTEER, who has been appointed superintendent of motive power and car equipment of the Quebec district of the Canadian National at Quebec, Que., was born at Quebec, where he began his railway service at the C.N.'s St. Malo shops as a messenger in 1919. After his apprenticeship, he became a machinist and served at Quebec, Joffre, Limoilou and Montreal. In 1940 he was appointed inspector at the company's shops at Toronto, Ont., and later the same year was appointed assistant foreman at London, Ont. In 1941 he moved to Hornepayne, Ont., as locomotive foreman, and two years later was transferred to Limoilou.

KENNETH CARTWRIGHT, who has been appointed general mechanical superintendent of the New York, New Haven & Hartford at New Haven, Conn., as announced in the May issue was born at West Epping, N. H., on March 14, 1890. He attended Massachusetts Institute of Technology (B.S. 1912)



For *lasting* insulation strength, Sperry counts on HARVEL 912-C

For more than 10 years, Sperry Gyroscope Company has been insulating coils and other components with Harvel Internal Curing Varnishes, because of their excellent mechanical and electrical properties. Sperry . . . world famous for the quality and performance of its instruments . . . reports these specific advantages from the use of Harvel 912-C, electrical insulating varnish:

1. *High mechanical strength.* Conductors rigidly bonded into a compact mass. No soft, tacky varnish interiors to allow movement of conductors.

2. *High dielectric strength* . . . 2200 vpm. Electrical properties retained at high temperatures—unaffected by oil.

3. *Fast baking time.* 912-C cuts baking schedules as much as 50%—materially reduces production costs.

Sperry also turns to Irvington for Class "H" flexible insulations when space and weight are at a premium. Running safely at temperatures as high as 500°F, these insulations permit using smaller conductors, and thus open the way to lighter, more compact designs. It will pay *you* to investigate these Irvington products—mail coupon today for the full story.

Look to
IRVINGTON
for insulation leadership
INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
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Instrument News

ONE PORTABLE TEST KIT FOR MOST ELECTRICAL RESISTANCE MEASUREMENTS

Here is how one railroad uses a Rectifier-Operated Meg Type of Megger® Insulation Tester housed in the same portable carriage with a Ducter® Low Resistance Ohmmeter and a Biddle Power Supply.



Photo courtesy Santa Fe Railway

The bar-to-bar test on the armature is being made with the Ducter using duplex hand spikes having a current and potential spike in each handle. In general bar-to-bar tests are more for the purpose of equalizing the resistances than for measuring their exact values.

The Ducter ohmmeter, which measures resistances as low as a millionth of an ohm, is invaluable for maintaining normal resistances in the series fields and armature windings of diesel-electric locomotive traction motors, switch contacts, cable joints, etc. Write for our interesting Bulletin 24-25-X or the comprehensive Ducter Manual 24J25-X.

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ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT



Kenneth Cartwright

and entered the employ of the New Haven on June 1, 1914, as material inspector at New Haven. After service in the United States Navy as lieutenant, j.g., he returned to the New Haven and served, successively, as assistant to engineer of tests, chief shop inspector, general mechanical inspector, assistant mechanical engineer and mechanical engineer. From September to November 1942 Mr. Cartwright was on leave of absence to study motive-power and rolling-stock requirements for the Vitoria a Minas Railway in Brazil. He was appointed chief mechanical engineer of the New Haven on April 1, 1944.

E. E. GLEASON, chief mechanical officer of the Western Pacific, has been given supervision of the Mulberry shops of the Sacramento Northern at Chico, Cal., which are being consolidated with the Sacramento shops of the parent Western Pacific. The consolidation results from the conversion of both roads to diesel-electric power—the W. P. from steam, the S. N. from interurban electric operation.

J. H. MILLER, of the mechanical department of the Toronto, Ont., Transportation Commission, has been appointed chief mechanical officer of the Quebec North Shore & Labrador, a new railway.

Diesel

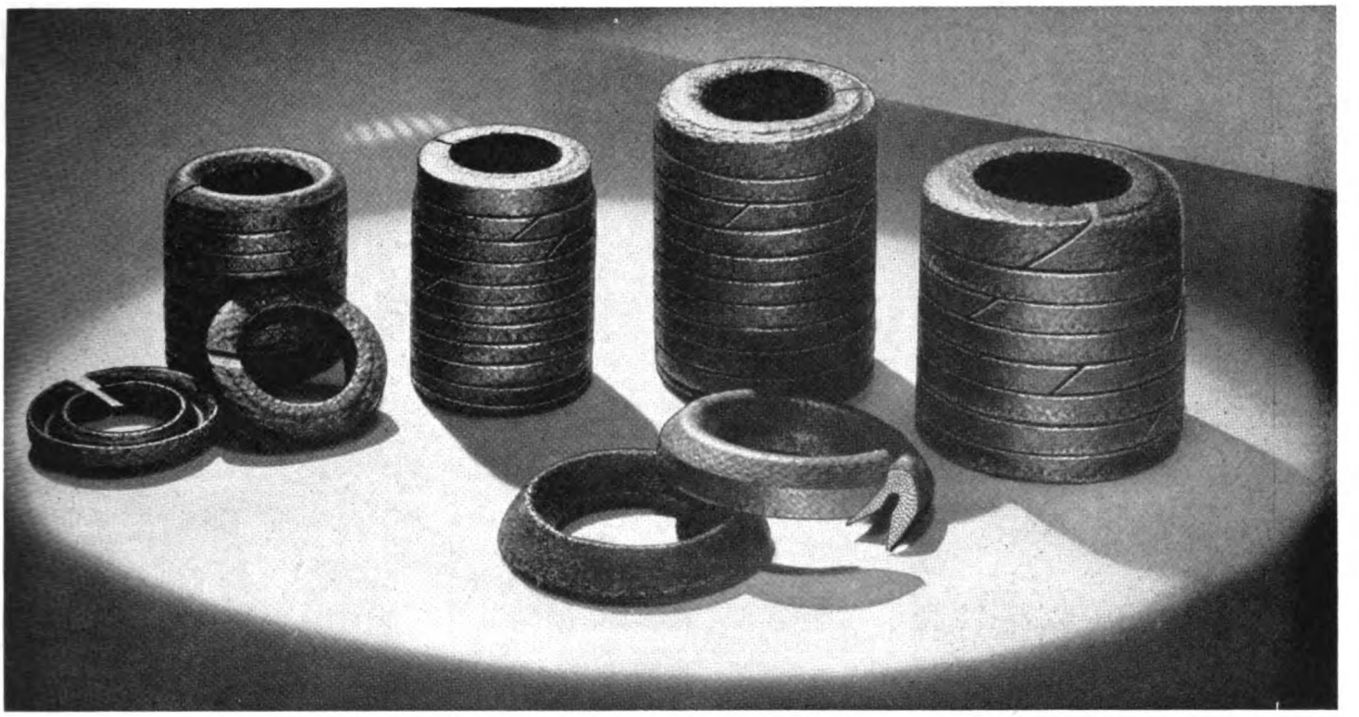
A. M. HAGEN, also division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis has been assigned jurisdiction over all diesel locomotive maintenance at Milwaukee.

H. C. POTTSMITH, assistant division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at LaCrosse, Wis., has been appointed a general diesel supervisor at LaCrosse.

HOMER FULLER, motive-power inspector of the Chesapeake & Ohio at Huntington, W. Va., has been appointed assistant supervisor diesel operation, with headquarters at Richmond, Va.

I. R. DIEHL, gang foreman of the Chesapeake & Ohio at Huntington, W. Va., has been appointed diesel electric supervisor at Richmond, Va.

(*Continued on page 118*)



GARLOCK 530 *Chevron* Throttle Packing.

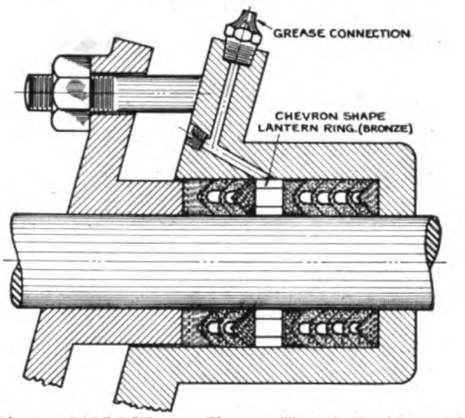
CHEVRON

Throttle Packing

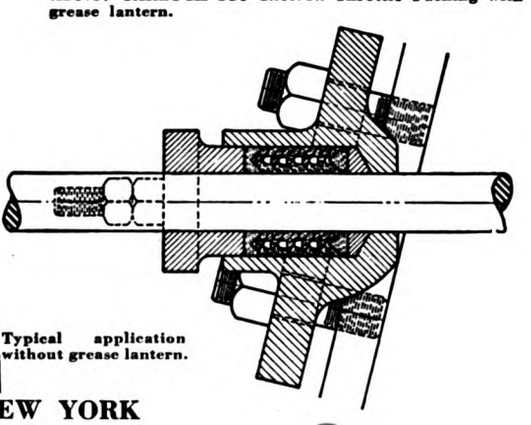
—for Efficiency and Economy

The use of Garlock *Chevron* locomotive throttle packing has increased efficiency and has effected substantial reductions in packing costs on many railroads. The exclusive hinge-like construction of the *Chevron* rings allows the packing to expand and contract and reduces friction to a minimum. Very little gland pressure is required. The result is a leakless, easy-operating throttle.

When installed with a grease lantern ring and a connection for a grease gun, a lubricant can be injected into the stuffing box. This makes for longer packing life and increases the ease with which the throttle can be opened and closed. Standardize on *Chevron* for your locomotive throttles!



Above: GARLOCK 530 *Chevron* Throttle Packing with grease lantern.



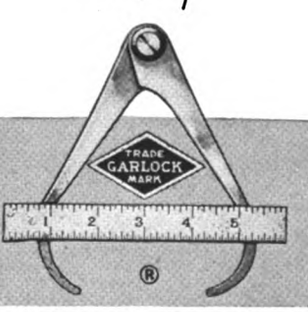
Typical application without grease lantern.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

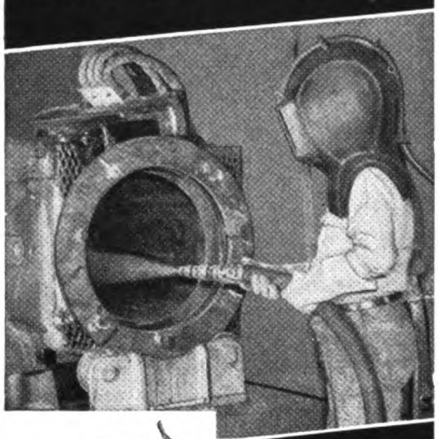
In Canada: The Garlock Packing Company of Canada, Ltd., Montreal, Que.

Branches in All Principal Railroad Centers

GARLOCK



CLEAN
Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER
with the right equipment for every job

(*Continued from page 116*)

J. E. HALL, JR., motive-power inspector of the Chesapeake & Ohio at Clifton Forge, Va., has been appointed supervisor diesel operation, with headquarters at Richmond, Va.

H. H. WORKMAN, equipment inspector of the Chesapeake & Ohio at Clifon Forge, Va., has been appointed general diesel supervisor at Richmond, Va.

WALTER E. TRUE, mechanical inspector at the Boston (Mass.) Diesel Terminal of the Boston & Maine, has been appointed acting assistant foreman at Mechanicville, N. Y., diesel terminal.

WILLIAM J. WHITE, assistant general diesel foreman of the Boston & Maine at Mechanicville, N. Y., has been appointed assistant general diesel foreman at Boston (Mass.) diesel terminal.

Car Department

H. N. THOMAS, foreman in the car department of the Chesapeake & Ohio at Huntington, W. Va., has been appointed general passenger car inspector at Huntington.

O. BORGESON, mechanical engineer of the Chicago & North Western at Chicago has been appointed engineer car maintenance.

EWING C. SHELLY has been appointed assistant general foreman car repairs of the Southern at Birmingham, Ala.

VERNON C. HENRY has been appointed foreman freight car repairs of the Southern at Valdosta, Ga.

JOSEPH D. CAMPBELL has been appointed foreman freight-car repairs of the Southern at Birmingham, Ala.

Master Mechanics and Road Foremen

W. H. MARSHALL, general foreman of the Chesapeake & Ohio at Newport News, Va., has been appointed assistant master mechanic at Newport News. The position of general foreman has been abolished.

CECIL D. SCHWINE, JR., general foreman on the Southern at Chattanooga, Tenn., has been appointed assistant master mechanic at Birmingham, Ala.

LAWRENCE J. BRASHER, assistant master mechanic of the Belt of Chicago, has been appointed master mechanic, with headquarters at Clearing Ill.

W. R. DOWNS, master mechanic of the New York Central at Avis, Pa., has retired after 47 years of service.

F. A. UPTON, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Miles City, Mont., transferred to Chicago as master mechanic.

E. POOL, district master mechanic of the Eastern district of the Erie at Jersey City, N. J. has retired.

(*Continued on page 120*)

INSTANT, DIRECT
Temperature Readings Accurate to within a Fraction of a Scale Division with

XACTEMP
Trade Mark Reg. U. S. Pat. Off.

HAND PYROMETERS



For All-around General Temperature Checking

Specify XACTEMP PYROMETERS wherever a quick, accurate temperature determination is needed. Used for surface temperatures of welds, welded rail ends, billets, slabs, heated rollers, forgings, ovens, hot plates, furnace walls—for general inspection in furnaces, lead and salt pots, galvanizing tanks, core ovens, type metal, etc. Long-life cast aluminum and brass construction. Medium resistance, fast-acting indicator, provided with Alnico V magnet—direct reading dial starts at 50° F. or 60° F. Simple, easy to operate—no adjustments necessary—always ready for use. Will take most types of thermocouples. A full line of thermocouples available from stock.

FOUR MODELS

Catalog No.	*Range*	*Thermocouple*
LT 800	60-800 F.	Iron-Constantan
LT 810	60-1200 F.	Iron-Constantan
LT 820	60-1600 F.	Iron-Constantan
LT 830	50-2500 F.	Chromel-Alumel

PRICE WITHOUT THERMOCOUPLE $42.50

Ask also about XACTEMP PYROMETERS for taking temperatures of molten non-ferrous metals

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Manufacturers & Distributors
Thermocouple Supplies • Industrial Furnaces & Ovens
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Star of NATIONAL TRADE-MARK standardized brushes



AZY

THE BRUSH GRADE FOR DIESEL-ELECTRIC TRACTION MOTORS

Broken brushes . . . . NO!

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Fine commutators . . YES!

plus SUPERB BRUSH LIFE!

● These statements are *facts*. Grade AZY brush is better than any brush ever applied to diesel-electric traction motors as proved by twelve million miles of rugged, on-the-job testing. Never before has there been a grade – GRADE AZY – combining physical strength with long life at high speeds without commutator wear.

This brush has a special, no-fray shunt cable. It has a unique, vise-tight shunt connection.

This brush is it, and you can get it, under National's unique standardization program, for the same low, flat price, whether you buy 1 box or 10,000 boxes. You get the best brush money can buy and you save money in the bargain. For complete information, write to National Carbon Company, A Division of Union Carbide and Carbon Corporation.

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NATIONAL CARBON COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

SLASH BATTERY COSTS IN HALF!

With the revolutionary new "Eveready" No. 1050 Flashlight Battery, you get these big exclusive features:

- More than twice as much light
- Whitest, brightest light available from a flashlight battery
- Half the cost for light output
- Leakproof – No metal can to leak or corrode
- Will not swell, stick or jam in a flashlight

Why? Because of "Eveready" No. 1050's exclusive "inside out" construction. Instead of being the container for the cell, the zinc electrode is on the inside to make the battery last longer, while the new outside carbon jacket makes the battery leakproof. *Order a supply of No. 1050's today.*



L. H. KABUN, district master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Chicago, has been transferred to the position of master mechanic at Miles City, Mont.

E. L. GROTE, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Mason City, Iowa, has been transferred to Minneapolis, Minn. The position of division master mechanic at Mason City has been abolished.

W. W. HENDERSON, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Savanna, Ill., has had his jurisdiction extended to include Sioux City, Iowa, and Calmar.

W. W. BATES, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has had his jurisdiction extended to include that part of the LaCrosse and River division from Milwaukee to LaCrosse and from New Lisbon, Wis., to Woodruff.

F. L. KING, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has been given jurisdiction over all steam locomotive maintenance at the point as well as the foundry.

J. H. KASMEIER, master mechanic of the Chicago division of the Chicago, Rock Island & Pacific, has been transferred to Fort Worth, Tex.

W. G. CARLSON, master mechanic of the Erie at Hornell, N. Y., with jurisdiction over the backshop, has been appointed district master mechanic of the Eastern district at Jersey City, N. J. The position of shop superintendent at Hornell has been abolished.

J. J. BACHUS has been appointed master mechanic of the Chicago division of the Chicago, Rock Island & Pacific.

E. BRANNING has been appointed master mechanic of the Erie at Hornell, N. Y.

Shop and Enginehouse

JAMES W. ADAMS has been appointed to general master mechanic of the Louisville & Nashville, at Louisville, Ky. Mr. Adams began railroading with the L. & N. as a machinist in July 1922. From 1926 to 1939 he served as president



James W. Adams

of the Association of Maintenance of Equipment Employes, subsequently acting as schedule foreman and erecting foreman for the L. & N. at South Louisville, Ky. He became assistant to superintendent at Louisville in July 1943, and assistant superintendent in January 1948.

F. H. WILBOURNE, gang foreman of the Norfolk & Western at Petersburg, Va., has been appointed foreman at Lynchburg, Va.

B. A. DENNARD has been appointed enginehouse foreman (night) of the Southern at Chattanooga, Tenn.

W. E. EMMONS, gang foreman at the Petersburg, Va., shop of the Norfolk & Western has been appointed foreman at Durham, N. C.

T. F. CALLANAN, boiler foreman at the Meadows, N. J., enginehouse of the Pennsylvania, has been appointed enginehouse foreman at Meadows.

R. W. LLEWELLYN, foreman, electrical department of the Chesapeake & Ohio at Newport News, Va., has been appointed general foreman-piers at Newport News.

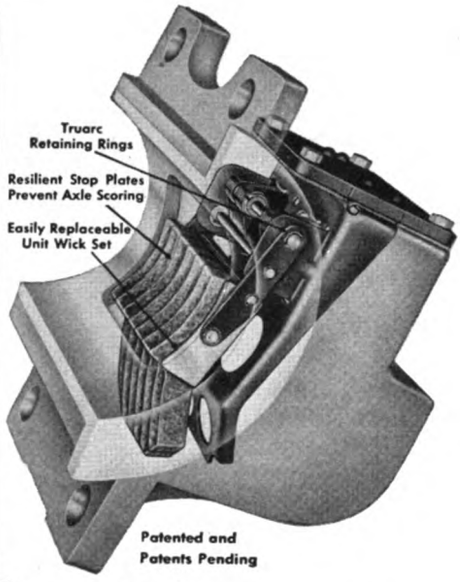
W. L. HEGERFELD, foreman at the Conway, Pa., enginehouse of the Pennsylvania, has been appointed foreman at the 46th street, Philadelphia, Pa., enginehouse.



CONTINUOUS SCIENTIFIC LABORATORY DEVELOPMENT



CONSTANT ON-THE-JOB PERFORMANCE TESTS. . .



Result! **Felpax Lubricators Reduce Support Bearing Maintenance as much as 75%**

INSTANT COMPLETE LUBRICATION with the first turn of the axle under heavy load conditions reduces babbit wipe and consequent early bearing damage. Continuous lubrication under high speeds provided by special felt wicks in constant contact with the journal insures longer bearing life.

MILLIONS OF MILES of trouble-free service on the nation's Class I Railroads have proved Felpax Lubricators provide the lubrication required to keep Today's Modern Traction Motors operating at peak efficiency.

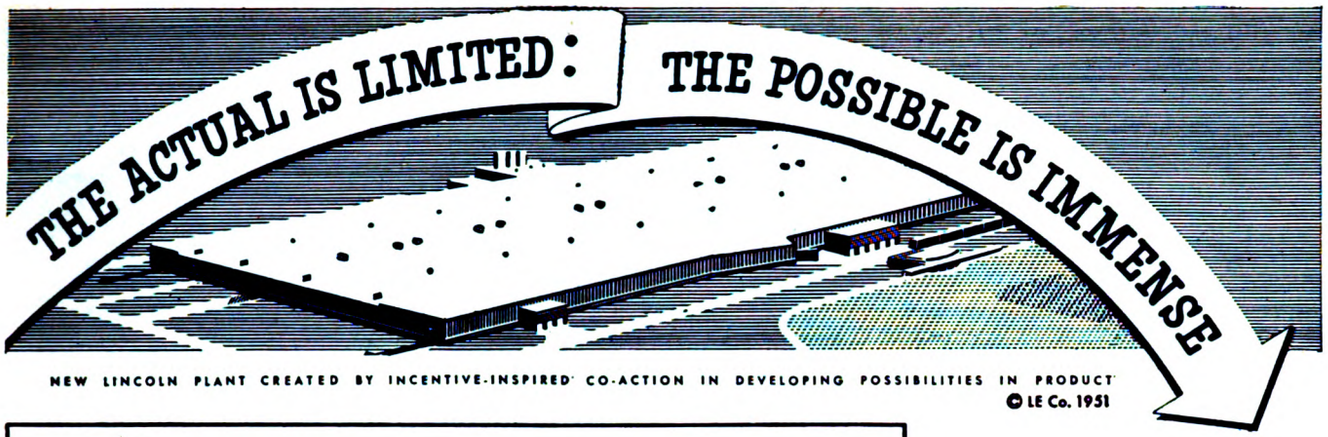
NO OTHER LUBRICATION METHOD provides all these *"Performance Proved"* FEATURES!

- **ELIMINATES waste packing and the human element involved.**
- **SERVICE reduced to periodic checking and filling oil sump.**
- **SPECIAL FELT WICKS eliminate waste grabs and starved bearings.**
- **REPLACEMENT of worn wick sets after thousands of miles of use is simplified by improved construction (see illustration above).**
- **COMPLETE KIT for replacement containing wick set, springs and necessary hardware available at nominal cost.**
- **NO MOVING PARTS subject to failure due to dirt, moisture and freezing.**

For full particulars see your locomotive builder or write to:



MILLER FELPAX CORPORATION
WINONA, MINNESOTA



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1951

SIMPLIFIED REPAIRS SAVE COSTLY MAN-HOURS

UTILIZING the economies of maintenance arc welding enables repair shops to handle their ever increasing volume of locomotive work even more effectively. Many time-consuming jobs are being side stepped with fast, simple welded repairs . . . to get equipment back in service faster and at less expense.

Worn surfaces are reconditioned by building up with weld metal or by adding bearing plates as shown. Where difficulties are encountered in obtaining conventional replacement parts, components can be redesigned for welded steel fabrication, often saving weeks of delay, as well as critically scarce man-hours.

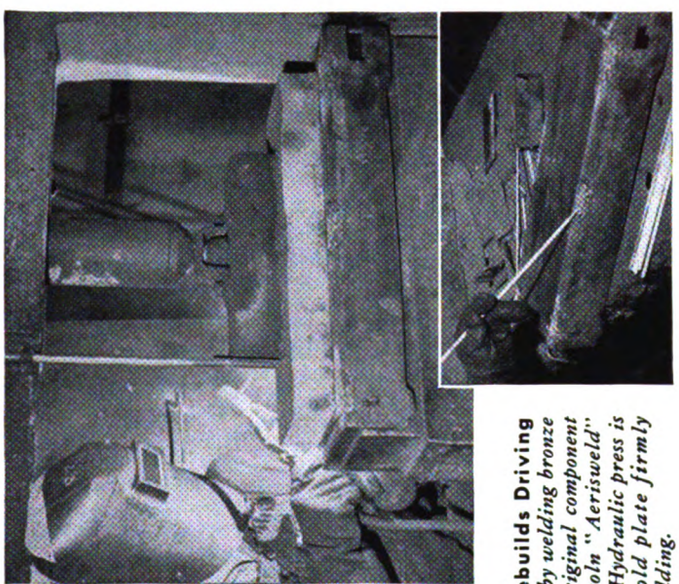


Fig. 3. Rebuilds Driving Box Shoe *by welding bronze plate to original component with Lincoln "Aerisweld" electrode. Hydraulic press is used to hold plate firmly during welding.*

GETS GREATER STRENGTH

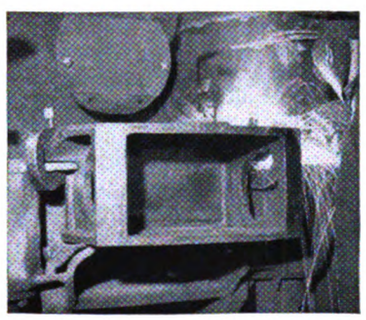


Fig. 1. Railroad Back Shop *replaces buffer casting by welding replacement unit to locomotive frame with Lincoln "Shield-Arc 85."*

AND LONGER SERVICE



Fig. 2. Installs New Mud Ring *by fillet welding replacement tubing to locomotive plate with "Fleetweld 5."*

SEE HOW THIS SHOP CUTS ITS REPAIR COSTS

For further information about arc welding procedures and equipment, write The Lincoln Electric Railway Sales Co., 11 Public Square, Cleveland 13, Ohio. Railroad representatives of

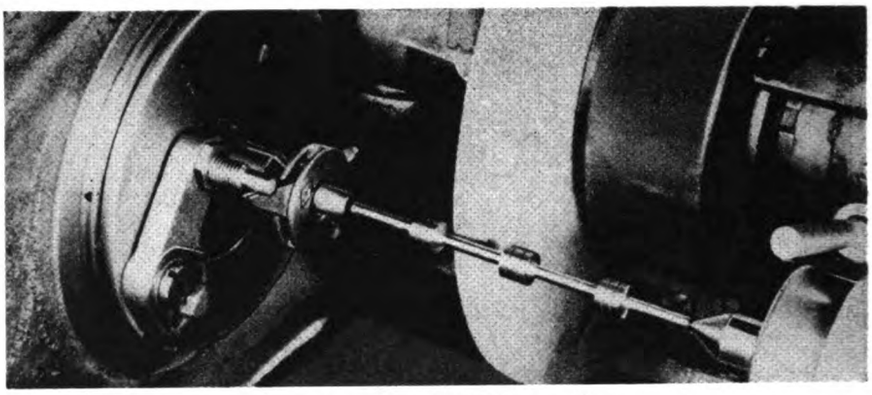
THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO

(Continued from page 89)

edges. Its ability, states the manufacturer to cut a single or double bevel accurately, recommends it for utilization in shops which do any amount of steel fabrication work.

Torches may be individually positioned vertically or laterally without changing the bevel angle. Fuel and preheat pressures are initially set with individual torch valves, and once set, the master valve controls turning-on and shutting-off gas supply without disturbing settings of the individual torch valves.



Cam action dog on grinding machine

Cam Action Dogs

On semi-automatics and on units where there is little traverse feed, the Ready Tool Co., Bridgeport, Conn., claims their cam action grinder and lathe dog will increase production and efficiency by saving time and labor. These devices are easy to adjust with instant, positive action. A concealed spring holds the cam to the work.

For grinders, the cam face is ground smooth, both surface and contour, protecting work from mars, thus eliminating spoilage and rejects. For lathes, the cam face is serrated to prevent slipping.

Construction is of steel with specially hardened cam face and set screws. The dogs are also available with brass cam and screws for use on grinding machines.

Use of the dog saves time; all that is required is to place the work in the dog, holding the cam against the spring tension with a finger, and set the two screws. When the cam is released, the work is held securely by the cam spring action. To remove the piece, just release the cam. Sizes are made to accommodate diameters from ⅛ to 6 in. capacities.

Full Vision Safety Goggles

To accommodate smaller faces, the American Optical Co., Southbridge, Mass., has developed the type 800 Panoram acetate safety goggle as a companion to their larger 600 Panoram style.

This goggle has replaceable plastic lenses that give shatterproof protection and undistorted vision. Comfort is provided by a lightweight plastic frame conforming closely to the forehead and face.

The eyecups combine protection with the necessary ventilation and have a wide protective area and an extensive visual field laterally for the wearer. These eyecups conform closely to the facial contours and all face contacting surfaces are broad and smooth.

Lenses may be replaced easily by unscrewing the clamp nut at the top of the center swivel rod. When loose, the frame snaps back allowing the lenses to slip out. This clamping nut stays on the post and cannot be lost.

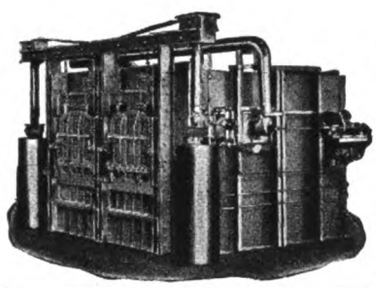
Goggles may be purchased with green or clear lenses and green or clear frames. Both goggle sizes are supplied with a rubber headband in place of the former elastic.



Circular Milling Attachment

For use with their smaller knee-type milling machines, circular or rotary milling attachments have been announced by The

To Serve
STEAM HAMMERS
FORGING PRESSES
BULLDOZERS



JOHNSTON

DOOR TYPE FORGING FURNACES

Johnston Door Type Forging Furnaces are unusually rugged, featuring heavy frame steel cased construction with walls 13½" or 18" thick. There is ample venting, and uniform distribution of heat. Johnston Reverse Blast low pressure burners for oil or gas assure rapid heating, and low cost of operation. Sizes and door arrangements built to suit. Send information on work to be done and we will be glad to make our recommendations.

OVER THIRTY YEARS EXPERIENCE IN THE DESIGN AND MANUFACTURE OF

BURNERS BLOWERS FURNACES RIVET FORGES
FIRE LIGHTERS TIRE HEATERS ALLIED EQUIPMENT

THE JOHNSTON LINE — SAFETY DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE
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ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT	RPM Delo R.R. Oil
UNIT	Locomotive diesel engines
SERVICE	Freight and passenger
OPERATION	Local and transcontinental
MAINTENANCE	Progressive

One million miles of service from engine parts!

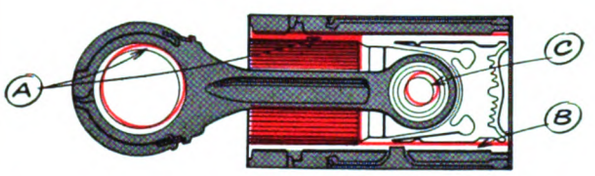
LUBRICATED WITH RPM DELO R.R. OIL, many diesel engines in the locomotives of U.S. railroads have been in service for long periods without complete overhaul! Many of the liners, pistons, bushings and other parts in these engines have now been in use for hundreds of thousands of miles. Progressive maintenance inspections indicate that RPM DELO R.R. Oil will keep the parts in service for at least one million miles, the general overhaul period set by some of the railroads.

RPM DELO R.R. Oil keeps parts clean and free of wear-causing lacquer and gum deposits and is not corrosive to engine metals of any kind.



IN OVERLAND MOUNTAINOUS FREIGHT SERVICE for nearly 500,000 miles, this liner, lubricated with RPM DELO R.R. Oil has less than 0.006 inch wear and taper is so minor that it is barely measurable.

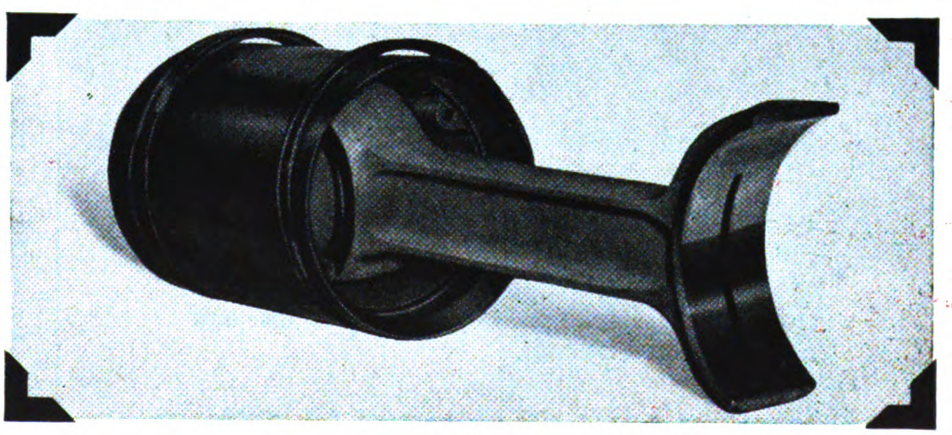
How RPM DELO R.R. Oil prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushing or bearing metals and foaming in crankcase.



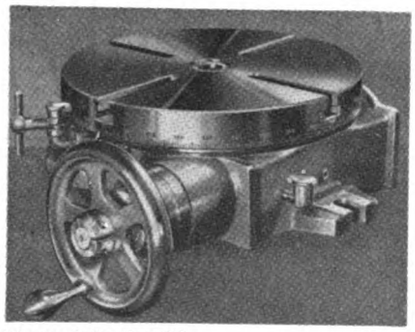
THIS PISTON AND CONNECTING ROD have been in service for more than four years. After picture was taken it was put back in the engine for further use. Note the excellent condition of the rings and bearing. All the rings are free, oil holes open and there are no troublesome deposits in any ring grooves.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any one of the companies listed below.

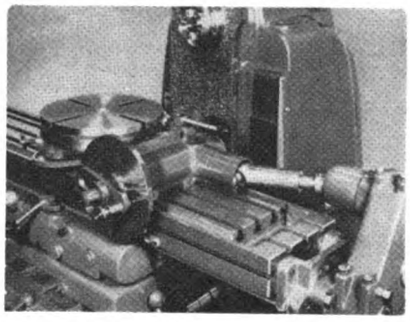
RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

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THE CALIFORNIA COMPANY • Denver, Colorado



Manual feed table



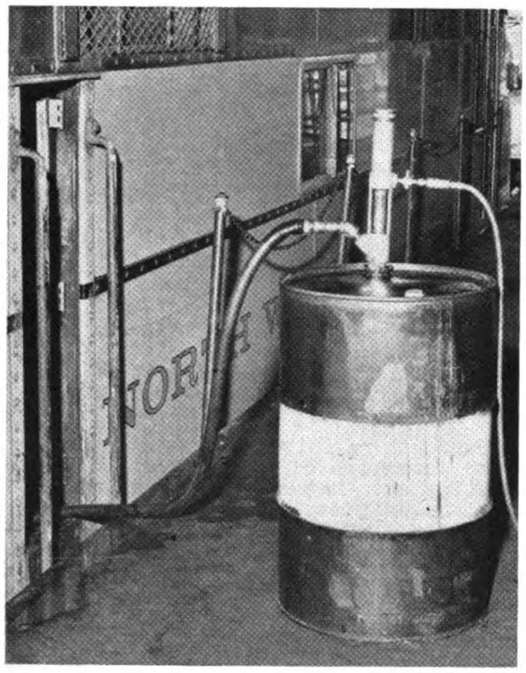
Power feed table

Cincinnati Milling Machine Co., Cincinnati 9, Ohio. They are intended primarily for toolroom work, but when properly tooled up become efficent high production units for performing milling operations on small parts.

The attachments are built in two styles: manual feed and power feed. For both styles, the table is 12 in. in diameter, machined with four standard 9/16 in. T-slots; rotated through a worm and wheel having 80 to 1 ratio; and graduated in deg. on its circumference. The handwheel dial is graduated in min.

The power feed attachment is driven by the machine on which it is mounted. A shaft beneath the table and parallel to the feed screw drives a gear train within the bracket attached to the right-hand end of the table. Power is transmitted from the gear train to the attachment by a universal jointed, telescoping shaft. A reverse clutch arrangement permits the table to be driven clockwise or counter-clockwise, or disengaged for manual rotary adjustment.

Both manual and power driven styles may be equipped with an auxiliary indexing attachment. This unit employs the same index plate as standard Cincinnati dividing heads. Other sizes of 16, 20 and 24 in. table diameters are also available.



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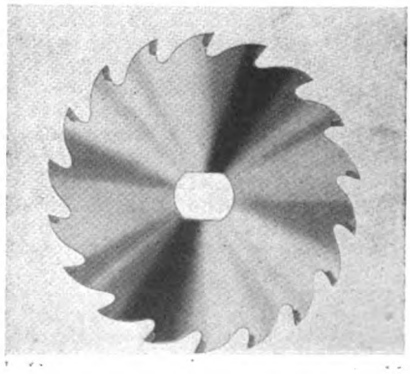
Carbide-Tipped Saw Blades

The introduction of carbide-tipped blades for their line of "Quick-Saw" portable electric saws has been announced by the Black & Decker Mfg. Co., Towson, Md.

The illustrated blade cuts faster than abrasive discs when sawing transite, cemesto board, masonite, formica and other abrasive or plastic composition materials. By test, it cuts ½-in. transite eight times faster than an abrasive disc. On 1- and 2-in. cemesto board, this blade cuts twelve times faster.

The device can be utilized for cutting wood because it has a special tooth design which makes a smoother cut than standard steel blades. After extensive field testing, it is estimated that a carbide-tipped blade stays sharp thirty times longer than standard blades and loses less diameter in the resharpening process.

They are available in three sizes: 7-in. (18-tooth), 8-in. (20-tooth) and 9-in. (22-tooth) and are designed to fit all recent model Black & Decker Quick-Saws.



RAILWAY
Mechanical and Electrical Engineer

JULY, 1951

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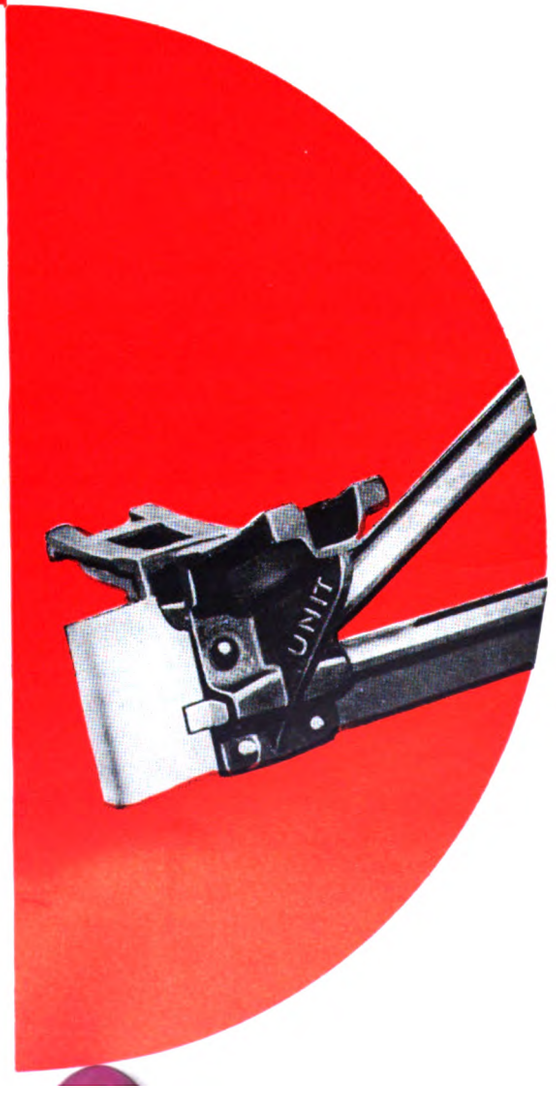
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BUFFALO UNIT



JULY, 1951
VOLUME 125
No. 7

RAILWAY Mechanical and Electrical Engineer

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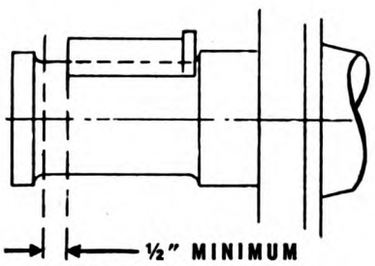
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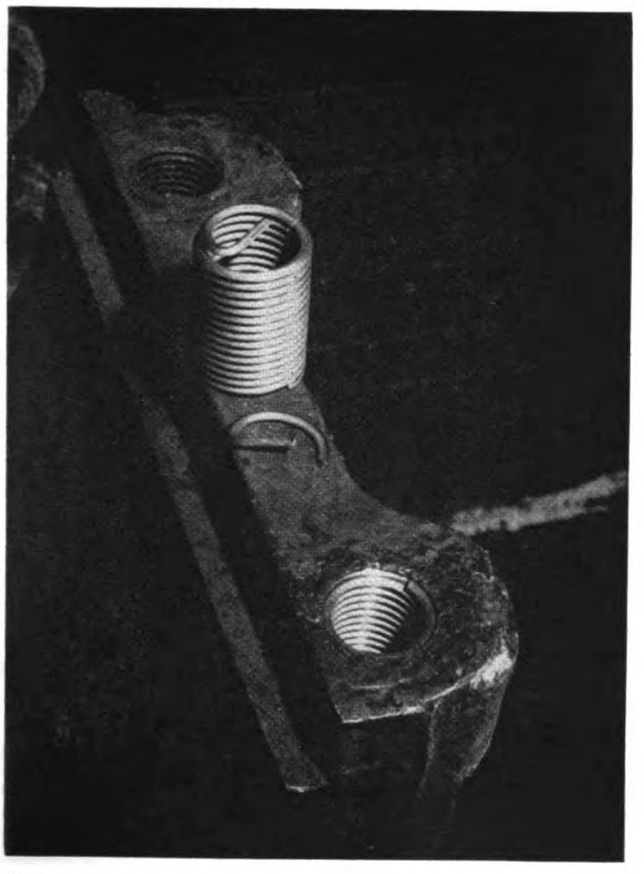
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RAILWAY Mechanical and Electrical Engineer

Helical Thread Inserts Help Speed Up Motor Repairs



Next to the repaired hole are the broken-off tang and an unmounted thread insert

HELICAL-wire thread inserts are speeding the repair of worn or stripped threads in the maintenance shops of a large eastern railroad. These repair operations are performed on electric and diesel-electric locomotives and multiple-unit cars where thread repair operations were formerly a costly and time-consuming problem. Savings in time resulting from the use of the wire-insert thread repair method amount to as much as 80 per cent as compared with methods previously used.

This maintenance shop has hte job of keeping over 70 multiple-unit motor cars in running order. uring the past two years, over 300 thread-repair jobs have been made in these shops using stainless steel Heli-Coil thread inserts. There is no record of a thread repaired with these inserts having stripped, pulled out, or shown any appreciable deterioration.

Typical repairs by this method include the replacement of damaged threads and broken studs in traction-motor bases, motor-housing cover plates, and quill-spring drive assemblies. Threads repaired are from ½ to 1½ in.

Wire-insert thread repair operations follow this pattern: (1) the damaged thread is cleaned out with a drill slightly larger in diameter than the major diameter of the original thread; (2) the hole is retapped with standard Heli-Coil roughing and finishing taps; and (3) a stainless steel Heli-Coil thread insert is installed, bringing the hole back to original size.

Of four possible thread repair techniques that can be employed to replace damaged threads—the oversize-thread method, the build-up by weld method, the solid-bushing method, and the wire-insert method—the latter has proved itself to be the most efficient in its consumption of time, labor, and materials, and the most effective in producing a more wear-resistant repaired thread.

The first technique, the oversize-thread method, is considered undesirable because of its space consumption, its need for using larger and more expensive bolts or studs, and its need for larger clearance holes in mating parts.

The second technique, the build-up by weld method is tedious, time-consuming and wasteful in its use of manpower and material handling equipment. It requires the following operations on parts having damaged threads: (a) transport by crane to a heavy-duty drill press, (b) positioning in the press to align the hole with the drill axis, (c) cleaning out the damaged threads with a greatly oversize drill, (d) transport on two different craneways to the welding department at the other end of the shop, (3) mounting in welding position, and (f) filling the hole with material deposited by welding.

After the part is (g) returned to the machine shop, it is (h) remounted in the drill press (if the press is not tied up with work) or transported to the storage area and then back again when the press is available. Next, part is (i) repositioned and aligned, (j) drilled out to minor diameter of original thread, and (k) tapped with three taps to bring hole to original thread size.

This technique was far from optimum for the following reasons: (1) it required too much handling—four crane lifts on two cranes over several hundred feet, (2) it produced material that was often porous and of low strength, and (3) there was a tendency for parts to warp from excessive applications of heat during welding.

The third technique, the solid-bushing method, while superior to the former two methods, is extremely tedious

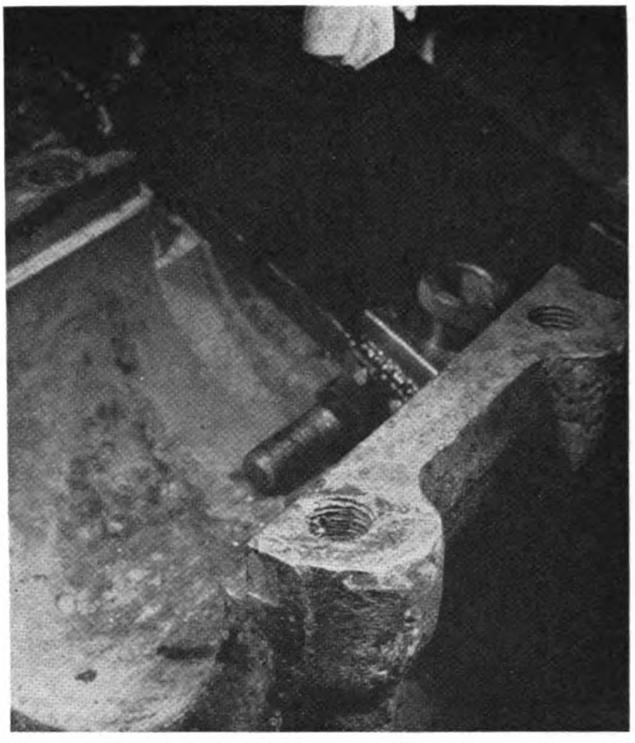
and time-consuming. With this method, after the part is properly positioned in the drill press, the repair operations follow this procedure: (a) the old threads are drilled out with an oversize drill, (b) a fine pipe thread is tapped into the hole, (c) a solid bushing of bar-stock is threaded to mating size, and (d) the bar-stock plug is inserted tightly into the hole.

When properly seated and locked in place, the plug is (e) cut off flush with the top of the boss. Next, the hole is (f) laid out, (g) drilled out with the same size drill that aws used to make the original thread, and (h) tapped with three taps to the originaly size. When the threading operation is finished, the face of the boss is (i) flushed off and the entrance threads cleaned out.

The fourth technique, the wire-insert method, has superceded almost entirely the first three methods and is now used for thread-repair operations. The badly worn 1¼-in. 7-thread hole in the traction-motor base shown in one photograph is to be repaired in this manner. After the base casting is positioned in a heavy-duty universal drill press, the thread-repair operation proceeds as follows:

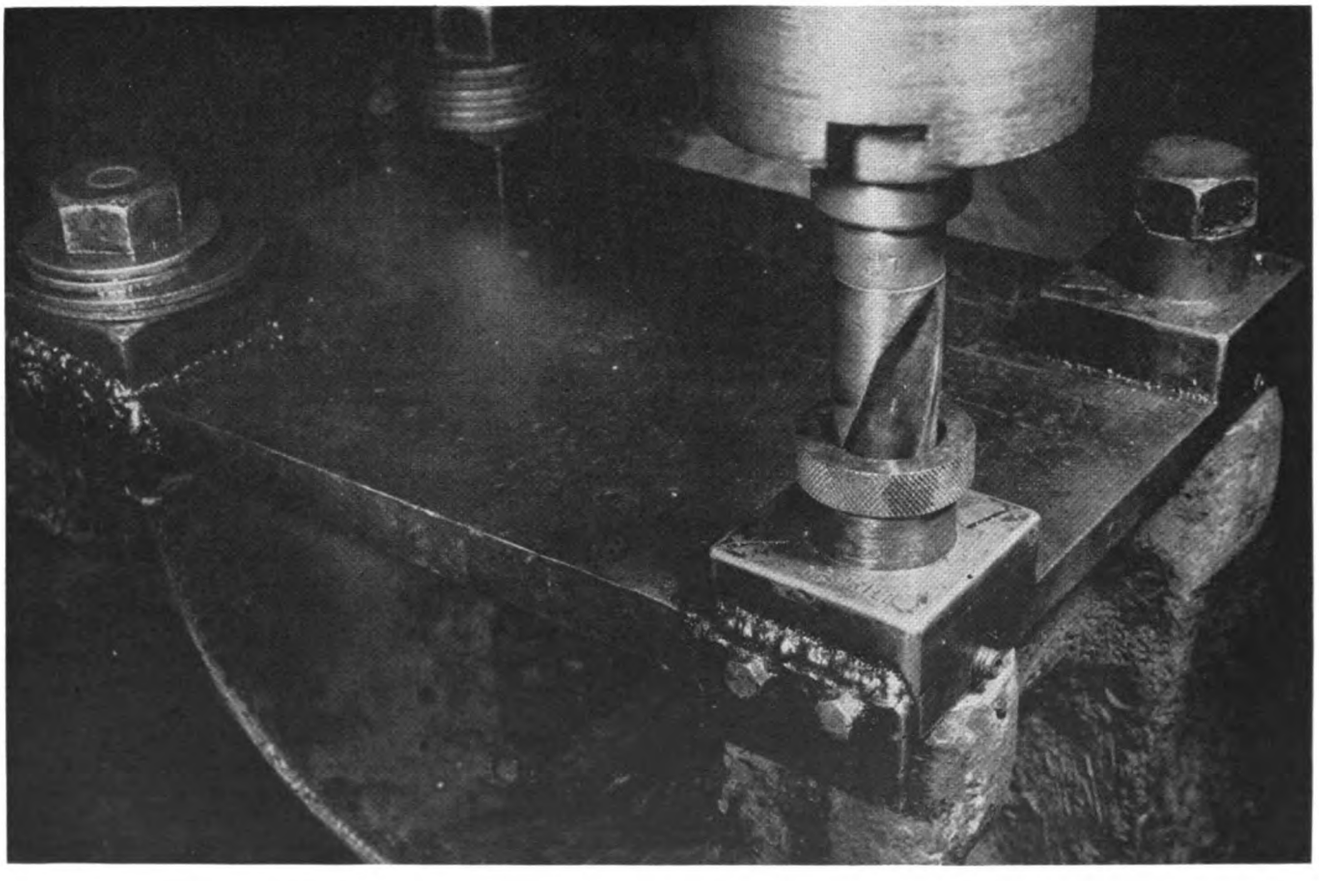
A drill-guide template is placed over the four axle-cap bolt holes in such a position that the guide bushing is over the damaged thread. The template is fastened to the casting with bolts screwed through guide holes into the three undamaged holes. Next, the worn threads are cleaned out with a 1-19/64-in. drill. The alignment bushing keeps the drill from being drawn off center as it would be if allowed to follow the irregularities of the damaged thread surface.

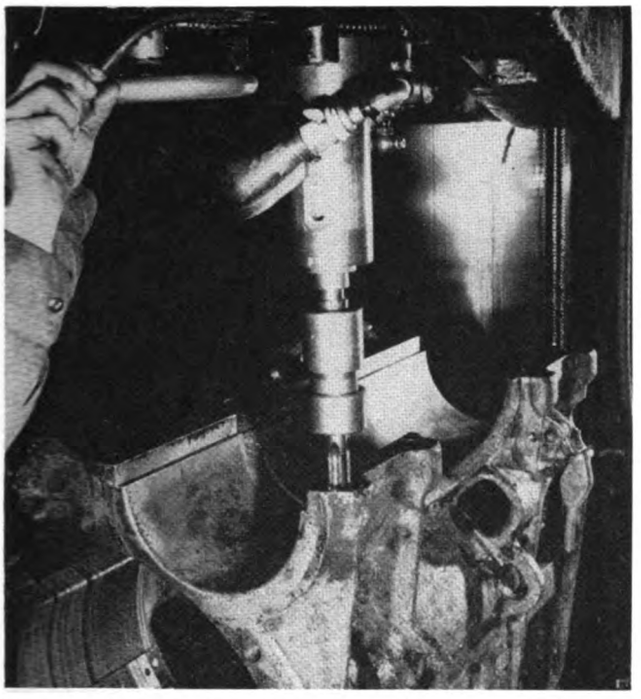
Thread inserts for through-holes have approximately the same length as the hole depth. To provide unob-



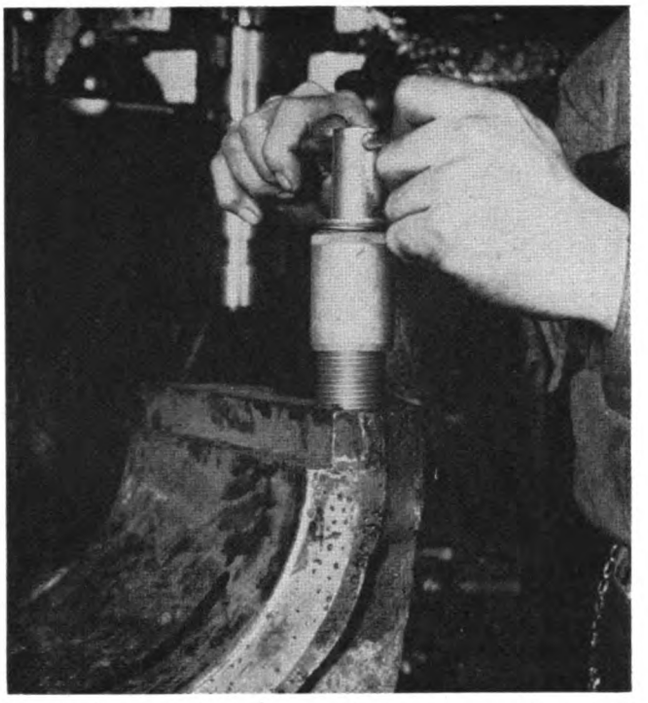
The worn axle-cap thread, foreground, in this multiple-unit motor casting is repaired by the wire-insert method

Damaged threads are cleaned out with a drill slightly larger than the major diameter of the original thread





The hole is prepared to receive the helical-wire thread insert by tapping with special Heli-Coil roughing and finishing tape



Installation of the insert to a depth of one-quarter to one-half a thread pitch below the surface is accomplished with an inserting tool

structed threads, the installing tang on the insert is broken off after insertion. However, in the case of blind-holes, the insert must be slightly longer than the required thread depth since the inserting tang is not removed later and therefore must be below and clear of the bottom of the bolt or stud. In order to insure an ample thread engagement in the given depth of boss, this blind-hole was drilled through, thereby making it a through-hole.

After the hole is cleared of its old threads, special-size standard-pitch threads to accommodate the outside contour of the insert must be provided. This is done by tapping the hole with two special taps labelled "1¼-in-7 Heli-Coil." These taps are keyed to and identified by the original hole size to avoid shop confusion. Instead of the customary three taps, only a roughing and a finishing tap are necessary for this operation.

When the second or finishing tap has been withdrawn and the chips blown clear, a 1¼-in.-7 Heli-Coil thread insert is installed by hand into the hole. The first step in this installation operation is the positioning of the insert on the inserting tool so that the tang fits into the slot of the spindle and that the tang will enter the hole first. When mounted in this manner on the inserting tool, the helical coil is ready to be screwed into the hole. This is accomplished by exerting a slight downward pressure on the tool until the first few threads are engaged. Once engaged, the installation is just a matter of turning the insert into the hole until it is a quarter to a half a thread below the surface of the boss.

Helical-wire thread inserts are made of stainless steel wire having a diamond-shaped cross-section. Each insert is precisely coiled to an outside diameter slightly larger than the major diameter of the tapped hole. As the insert is screwed into the hole, the action of the inserting tool slightly reduces the free outside diameter of the coil. This reduction in diameter brings the outside diameter of the insert to the size of the hole. It also develops internal stresses in the wire that are sufficient permanently to lock the insert in place. After installation, no amount of bolt tightening will rotate the insert. However, it can be removed by hand with another tool.

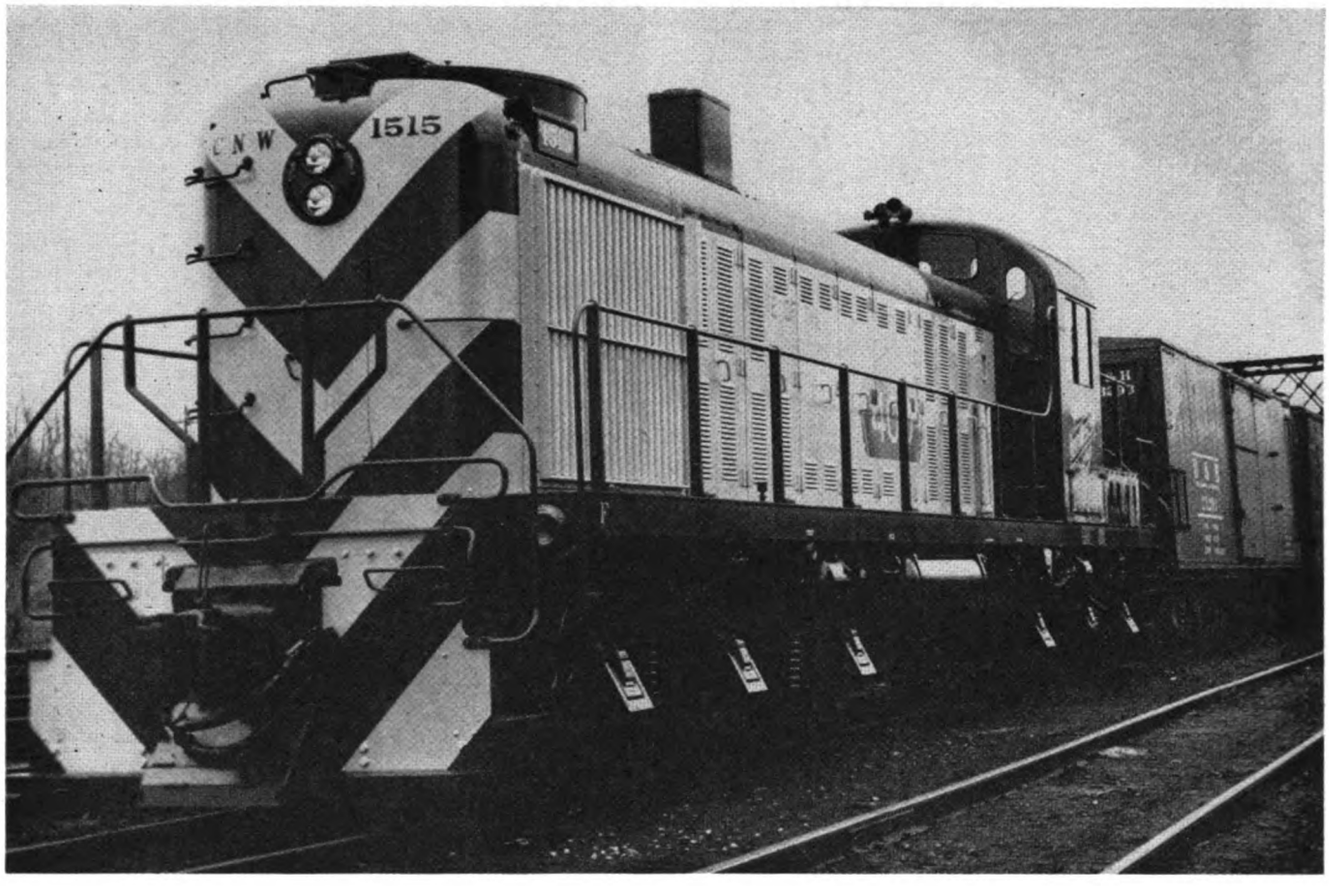
The next step after insertion is the tank-removal operation, when this is necessary. This is done by giving the tang a sharp blow with a tang break-off tool designed for this purpose. The tangs, which have a vee-shaped notch in them to aid in the removal operation, break off because of the combined bending and shearing action caused by the down-moving break-off tool.

The worn thread, shown in one illustration, had been previously repaired by the build-up by weld method. After a period of severe service, the threads failed again. The failure was attributed to the inherent porosity and relatively low strength, toughness and hardness of the weld-deposited material. Threads tapped into this material are said to have low wear-resistance as well as inferior load-bearing qualities. However, the physical qualities of the 18-8 steel wire used in the manufacture of the inserts is such that permanent threads can be successfully provided in the same welded material that produced the inferior threads.

In addition to the fact that the wire inserts are made from a material having a tensile strength of 180,000 psi, greater load-bearing qualities are achieved because the flexibility of the coil allows the load to be equally distributed over each thread rather than over just a few threads.

Time savings resulting from the use of the wire-insert method are considerable. The threads in the part described were repaired in 15 min. with the wire-insert method as compared with about 1½ hr. for the build-up by weld method, and more than this for the solid-bushing method.

Since with the use of an extraction tool, helical-wire thread inserts can be readily backed out of the holes if this should become necessary, any further thread repair operations on these same holes would require only the removal of worn coil and reinsertion of a new one.



Six Motor Road Switcher

THE Alco-G.E. 1600 hp. road switcher is now available with six traction motors for heavy duty drag and hump service and in other applications where high tractive force is required, it was announced by American Locomotive and General Electric.

This road switcher is the same basic design as the Alco-G.E. four-motor road switcher, of which more than a million-and-a-quarter horsepower have been delivered to the railroads since 1945.

The two three-motor, three-axle trucks are of the drop-equalizer, modified swivel type. They are designed for ease of maintenance, equal weight distribution and smooth riding at high speeds.

The truck has been designed so that the center motor is fully accessible for all inspection and servicing. Adequate working space within the truck frame at both ends of the center motor is provided.

The truck design is a departure from the usual swivel type. A center plate, offset from exact center, is used as a turning point as in regular practice, but carries only a portion of the load on the truck as the two loading pads support the remainder. This results in equal axle loading despite changes in load. The loading pads are fixed to the locomotive underframe and slide on load carrying plates located on the truck frame. Both center plate and loading pads operate in oil baths.

Arrangement of long equalizers and deep-deflection springs contributes to smooth riding at speeds up to 60 m.p.h. The spring system of the truck consists of four groups of two helical springs each, located near each end pedestal. The truck frame is supported on these springs which in turn are carried on four sets of double, drop-center equalizers extending from the end axles to the center axle. Desired equal axle loadings are attained by proper positioning of springs along the spans of the equalizers and by proper proportioning of the springs. Friction type snubbers are applied in one spring of each group.

The center plate of the truck is located on a cross transom between two motors. The loading-pad bearing surfaces are located similarly on the other transom at the opposite end of the truck. By placing the load carrying members between motors, advantage is taken of the deep transom sections for carrying the load to the side frames. This allows low overall truck height and enables use of the same basic locomotive design as the Alco-G.E. four-motor road switcher.

Standard weight of the six-motor road switcher is 360,-

000 lb., but it can also be supplied with total weights of 270,000, 280,000, 300,000 and 325,000 lb. The locomotive has a continuous tractive capacity of 78,750 pounds at 5.5 m.p.h., using 74:18 traction motor gearing. This compares with the 52,500-lb. tractive force at 8.5 m.p.h. of the Alco-G.E. four-motor road switcher. Tractive force of the new model is equivalent to 21.8 per cent adhesion with maximum locomotive weight of 360,000 lb.

The locomotive has a maximum permissible speed of 60 m.p.h. and may be used in freight or passenger service. For branch line work, where light rail and bridge limitations are encountered, the locomotive can be furnished in lower weight ranges. The first six-motor units were delivered to the Chicago and North Western in April.

Electrical Equipment

The six traction motors are the standard G.E.-752, as used on all Alco-G.E. road locomotives. New insulation and design permit continuous current of 1085 amperes per motor.

Lubrication periods for traction motor armature bearings have been extended to 300,000 miles. Permanently packed high-temperature lubrication of the traction motor armature bearings, adopted as standard almost two years ago, has proved most successful, and is being continued. This lubrication, operated from overhaul to overhaul without greasing service, has not only reduced maintenance but has also increased armature bearing reliability and life. This sealed lubrication is applied to all grease-lubricated electrical rotating equipment of this locomotive.

Progressive overhaul scheduling has extended the maximum life of traction motor armature bearings through three additional overhaul periods to 1,200,000 miles. The motor suspension bearings are equipped with felt-wick lubricators, which provide lubrication equal to expertly packed waste, but require less skill in maintenance.

There are three traction motor connections: (1) series-parallel with three motors in series and full field; and (2) parallel with two motors in series and full field; and (3) parallel with two motors in series and reduced field.

Balanced weight distribution in conjunction with the latest wheel-slip protection combine to assure fullest use of the traction motors' high tractive capacity.

The wheel-slip protective system, operating in connection with the amplidyne excitation system, removes power instantly upon wheel-slip, then reapplies power gradually to prevent recurrence of slip. This gradual reapplication of power is particularly important in the six-motor road switcher, which must operate much of the time at values of adhesion approaching the upper limit, where sudden reapplication of power would in a great number of cases cause wheel-slip recurrence.

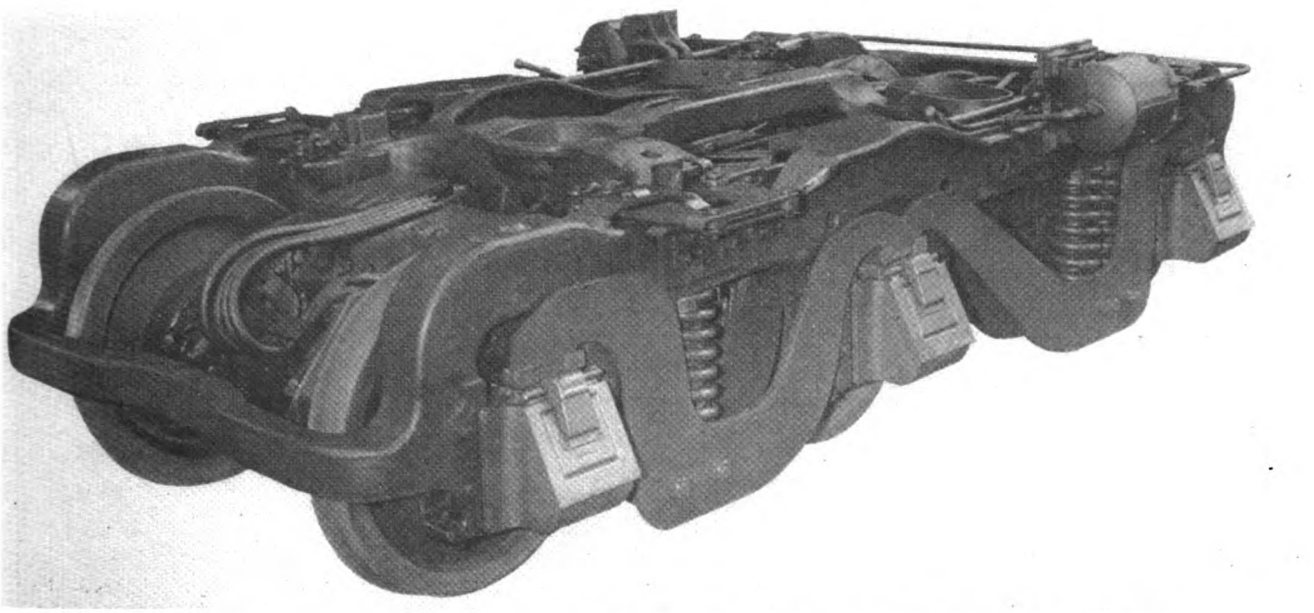
A contactor compartment at rear of front hood contains electrical control equipment.

Contactor compartment apparatus is accessible through doors in the wall of the operating cab and through panels in the partition. Louvres allow for adequate ventilation. Switches and meters are contained in a panel mounted on the compartment wall at the front of the operating cab where they are accessible to the operator in the cab. Dynamic braking equipment, when used, is installed in the rear compartment.

The main generator is a direct current machine containing main and starting windings. The generator is directly mounted on the diesel engine, requiring only one generator armature bearing. Auxiliaries, consisting of one amplidyne exciter, one auxiliary generator and one mechanical traction motor blower, are gear driven from the main generator. The amplidyne exciter is part of the power plant regulation system, and the auxiliary generator supplies power for lighting, battery charging and control circuits. The auxiliary generator operates at constant voltage under control of a regulator. The multi-vance traction motor blower supplies air to the three traction motors on the rear truck. Cooling air for the front truck is supplied by a blower, belt-driven from the engine.

The storage battery is a 32-cell, 426-amp.-hr. lead-acid type. It is installed in two battery boxes, one on either side at the rear of the operator's cab, above the underframe, with 16 cells in each box.

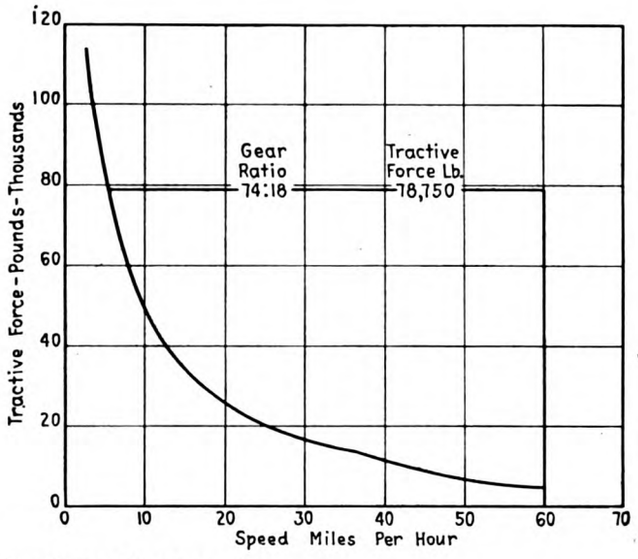
All lights are connected to the storage battery through



The traction-motor truck is of special center plate construction designed to distribute the load



The truck is so designed that center traction-motor and other maintenance work can be performed without its removal from the locomotive



Speed tractive-force curve

circuit breakers and light switches. Operating cab illumination is provided by ceiling and gage panel lights. Lighting is also installed in the front and rear hoods and in the contactor compartment.

There is a headlight of the flush type with a 14-in. glass reflector at each end of the locomotive. Each is fitted with 250-watt, 32-volt lamp with dimming control.

Numeral boxes with electric lighting are applied on each side of the hood at each end of the locomotive.

Underframe and Cab

The underframe is a steel weldment and the superstructure is of welded steel plate. The low front and rear hoods provide all-around visibility for the locomotive crew. The hood in front of the cab covers the engine and other apparatus. The radiators are located in the forward end of that hood. The section of hood over engine and generators is removable. There is a bulkhead which isolates the generator. Doors in the sides and roof of the hood provide access to equipment. The rear hood provides space for steam generating equipment.

The cab is of welded steel with controls on the right side facing the engine hood and a second seat on the left side of the cab. Doors are located in the right side of the rear wall and the left side of the front wall, as well as in the rear cab wall for access to the rear hood.

Engine and Controls

The locomotive is powered by an Alco Model 244 engine which is a vee-type 1,600-hp. unit having 12 cylinders of 9-in. bore and 10-½-in. stroke and a full-load speed of 1,000 r. p. m. The engine is turbosupercharged. Engine starting is effected by using the main generator as a motor, with current supplied by storage battery. Gear driven centrifugal pumps circulate water through engine, radiators and lubricating oil filters. Air flow through the radiators is controlled by modulated shutter control and by the variable speed of the radiator fan, which is driven by an eddy-current clutch.

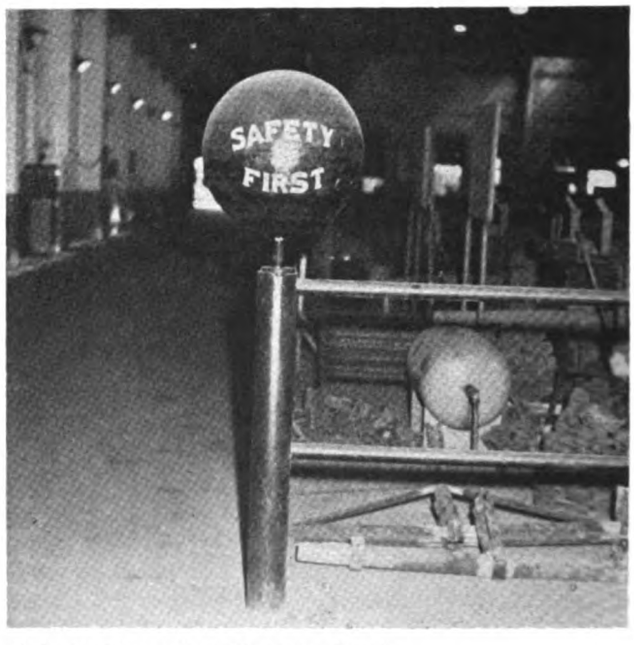
Engine lubrication is by means of a gear-driven pump with an oil reservoir in the engine base. In case of low oil pressure, the engine is stopped by automatic controls.

The engine control stand at the left of the operator's seat contains throttle, selector handle, reverser handle, air brake valves, and circuit-breaker type switches for generator field, fuel transfer pump and control circuits, headlight switches, light switches, air-brake gages, speed and transition indicator, load meter, and wheel-slip indicating lamp, as well as signal lights for low oil pressure, high engine water temperature, and ground relays.

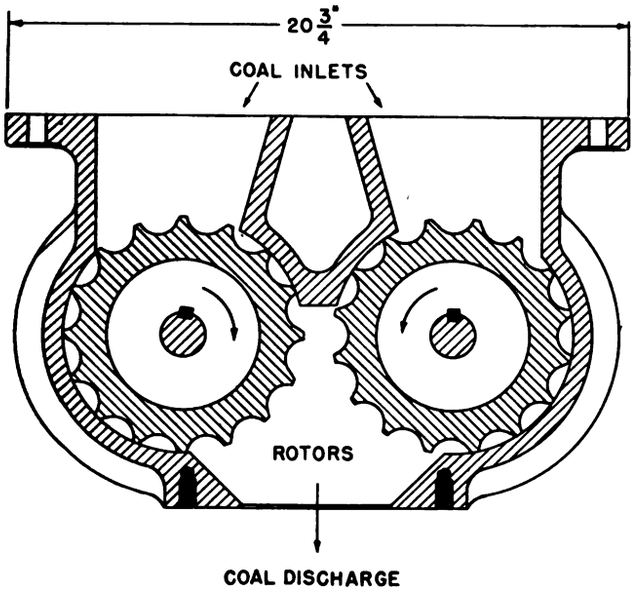
The air brakes are schedule 6-SL. Air is supplied by a two-stage, three-cylinder compressor direct driven by the main engine. The displacement at idling speed (350 r. p. m.) is 78.7 c. f. m. and at full engine speed (1,000 r. p. m.) it is 225 c. f. m. Two main reservoirs below the underframe, have a total capacity of 60,650 cu. in.

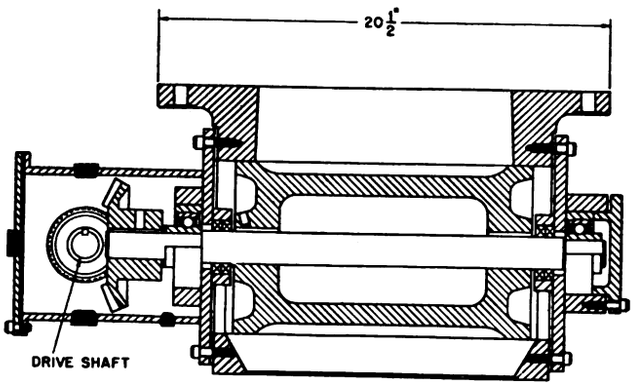
Steam generators may be applied with capacity up to 3,500 lb. per hour with a 750-gal. water tank. When the water storage tank is not required a 1,300-gal. fuel oil tank may be used instead as a modification.

* * *



(Atlantic Coast Line, Emerson shops)





Rotolock pulverized coal feeder.

Tests of Coal-Burning Gas Turbine Under Way

Feed controls, combustor and ash-removal system developed on Dunkirk experimental plant under test on locomotive power plant

*By John I. Yellott, Peter R. Broadley and Frederick D. Buckley**

[*The paper from which this article is taken is entitled "Progress Report on Coal-Burning Gas Turbine" which was prepared by the authors for presentation on April 6 before the Midwest Power Conference at Chicago. The report is in two parts, the first of which is a final report on 1,000 hr. of operation of the experimental turbine plant using the Houdry-process gas turbine. The second part deals with the test installation of the Allis-Chalmers locomotive turbine, most of which is omitted from this abstract.—Editor.*]

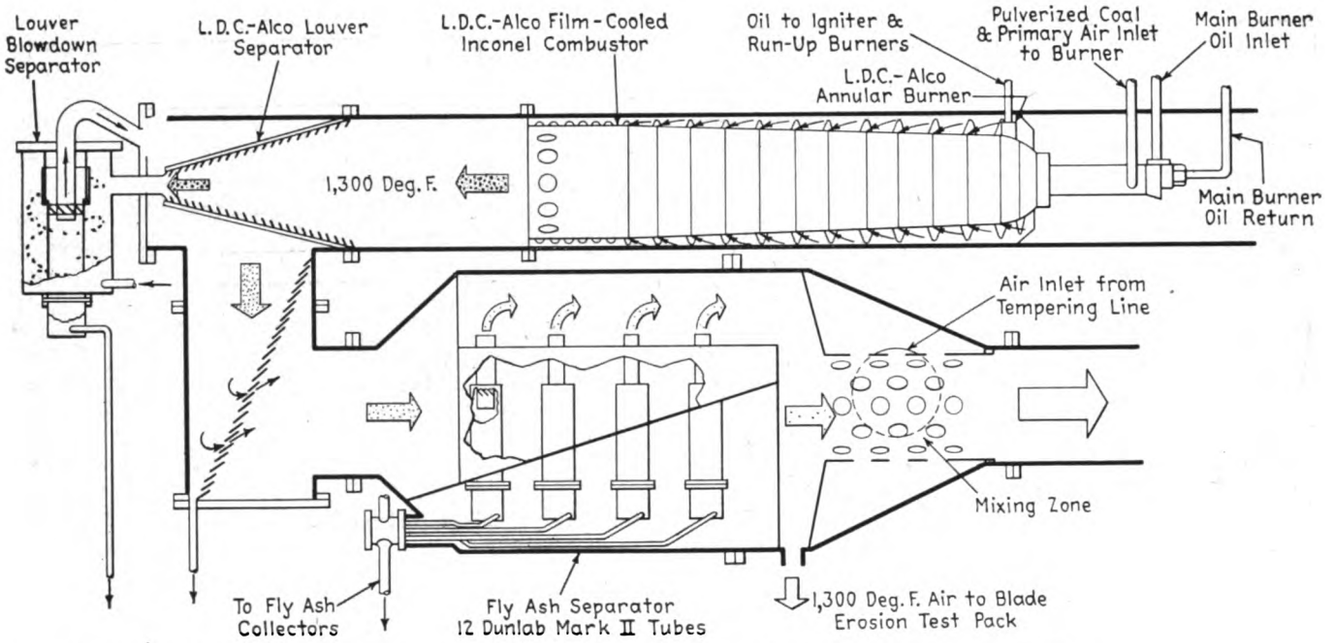
THE Locomotive Development Committee of Bituminous Coal Research, Inc., has now operated a full-scale Houdry process gas turbine with coal as its primary fuel for 1,000 hr. As a result of this experience combustion and ash-removal equipment has been constructed with which a 4,200-hp. Allis-Chalmers locomotive-type turbine will soon be in operation on a stationary test bed at Dunkirk, N. Y.

Operation of the Houdry turbine on a direct-fired open cycle has demonstrated the feasibility of feeding pulverized coal into a combustion chamber which runs at 45 to 60 p.s.i.a. Equipment for continous removal and discharge of the resulting ash has been developed. Blade erosion has been largely confined to the stationary blades of the experimental turbine and to regions of the turbine where the unremoved ash was apparently concentrated by centrifugal forces in the inlet piping. Extent of erosion depends upon dust concentration and upon particle size. There are strong indications that —10-micron particles are relatively harmless. Particles larger than 25 microns (.001 in.) in diameter are capable of causing severe erosion and must be removed in order to prevent damage to turbine cylinder blades.

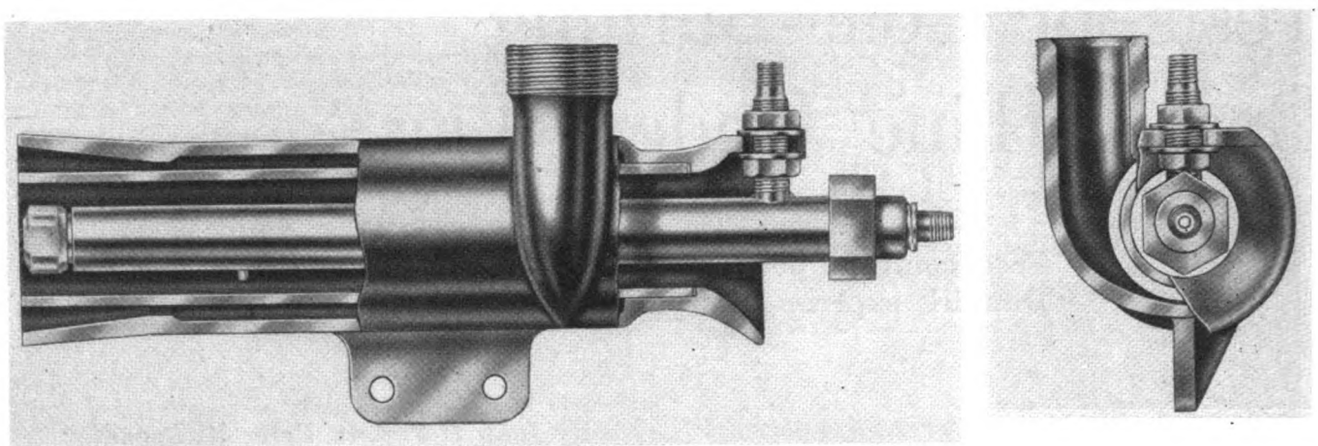
Combustion System

A number of burners and combustors have been tested. The best combination is shown in two illustrations. The combustion chamber is essentially a film-cooled stainless-steel enlargement of a jet-engine combustor. The coal is carried into the system by primary air at a ratio of 1 lb. of coal per pound of air. Air-coal velocity

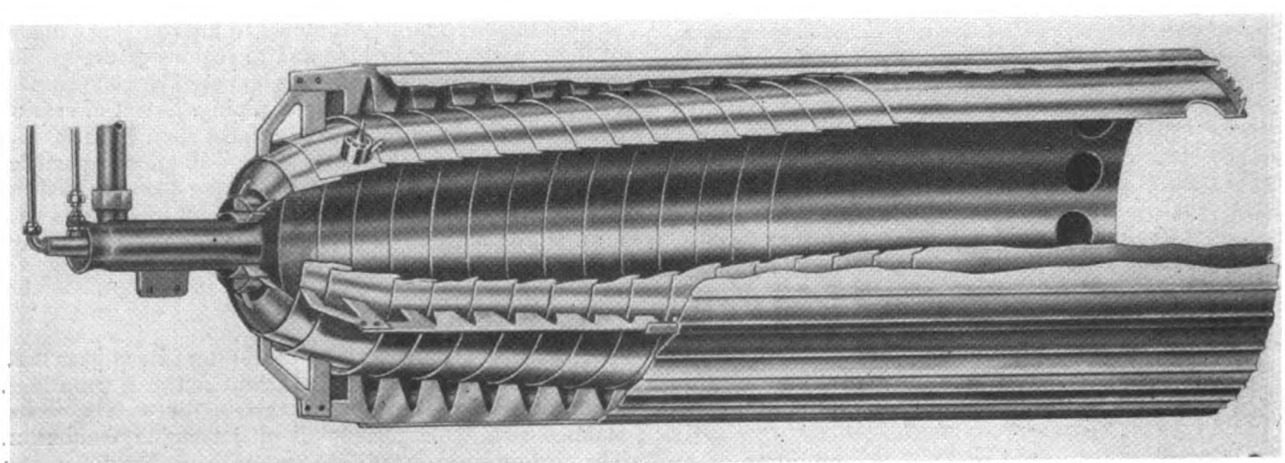
* Mr. Yellott is director of research, and Mr. Broadley, assistant director of research, Locomotive Development Committee, and Mr. Buckley, manager, Research and Development division, L.D.C. Project, American Locomotive Company.



Arrangement of the combustion and ash-removal equipment for the experimental gas turbine at Dunkirk



The Dunkirk annular burner for pulverized coal and oil. Connections, from left to right, are coal and air inlet, oil inlet and oil return. The annular passage is for the coal-air stream. The Peabody oil burner tip is in the center of the secondary air passage



The L.D.C. film-cooled combustor

is kept above 50 ft. per sec. to eliminate any possibility of flashback through the burner.

The L.D.C. annular burner, shown, developed at Dunkirk, provides a central location for a Peabody wide-range oil burner which is cooled by secondary air entering the combustor. The coal-air stream swirls out of the burner with clockwise rotation imparted by the tangential inlet. The secondary air entering around the burner is given a counterclockwise spin by vanes. The resulting turbulence causes the flame to be quite short and intense, while additional air enters through slots to keep the combustor head relatively clean and cool.

An oil-fired ignitor is located in the combustor head. This ignitor, also a Dunkirk development, uses a small stream of "ram" air to bend a hot spark into the oil spray, thus keeping the spark plug clean and cool. A flame-on indicator is being developed to replace the sight glasses which are now in use to enable the operator to know when the combustor is lit off. This indicator uses two chromel-alumel junctions, one of which is exposed to the ram air and shielded from the flame, while the other "sees" the flame directly. The small e.m.f. generated by the thermocouple is fed to a magnetic amplifier which boosts the current up to the point where a relay can be operated.

The principal problem in combustor design is to devise a method of support which will keep the film-cooling slots open after the metal becomes hot. The rings must be allowed to expand radially, but must be restrained axially. The strong-back arrangement in the combustor evolved from ideas tried at Battelle Memorial Institute and at Fontana, Calif. This design was given more than 250 hr. of satisfactory service and will be used in the locomotive turbine. A new design, affording more radial flexibility, is currently being tested in the Houdry unit.

Combustion efficiency with the L.D.C. film-cooled combustor is affected primarily by coal fineness and air-coal ratio. All tests up to the present time have been run with a high-volatile Pittsburgh No. 8 bituminous coal. It has been felt that enough variables were present without introducing the additional problems presented by different types of coal.

If coal fineness is held constant at about 97 per cent —100 mesh, 90 per cent —200 mesh, the combustion efficiencies shown in Table I may be expected for high-volatile bituminous coal.

The Canadian Bureau of Mines has conducted a series of tests on coals of various ranks, using a film-cooled combustor similar to that referred to here. They have found that combustion efficiency varies directly with volatile content. It is probable that low-volatile coals will require a hot-wall (ceramic) combustor for acceptable efficiency. Coals of the lowest rank, such as lignite, should give even higher efficiencies than those listed in Table I.

From a mechanical point of view, the combustor is surroudnded by a radiation shield which is made of 1/16-in. Type 347 stainless steel. The combustor is secured to the pressure shell at the burner end and is free to expand axially.

At the present stage of deveopment, the igniter remains in use while coal is being burned. It is felt that the expenditure of about 8 gal. of diesel fuel per hour is a good insurance premium against loss of flame due to a momentary interruption of the coal supply. Without the ignitor, the coal flame alone can be maintained over a turn-down ratio of at least four to one, but the subject of range has not yet been completely investigated. Since there is no ceramic material in the combustor and the metal cools almost instantly when the flame is extinguished, there is no source of reignition other than the ignitor in case of fuel failure.

TABLE I—COMBUSTION EFFICIENCY vs. TEMPERATURE RISE

Temperature rise, deg. F.	300	400	500	600	700
Combustion efficiency, per cent	81	83	86	93	95

Ash Removal

The development of the direct-fired, coal-burning gas turbine has presented many difficulties, but by far the most fundamental and vital problem is ash removal. Various solutions and compromises may be found to all other problems, but ash removal must approach perfection if the turbine is to have an acceptable life. The question of ash removal is very severely complicated by the tremendous range of ash particle size. Ash fragments have ranged from dislodged deposits 12 in. long to submicroscopic particles. Equipment which separates particles in the 20-micron size range is subject to clogging when confronted with 1-in. slugs.

Louver Separator

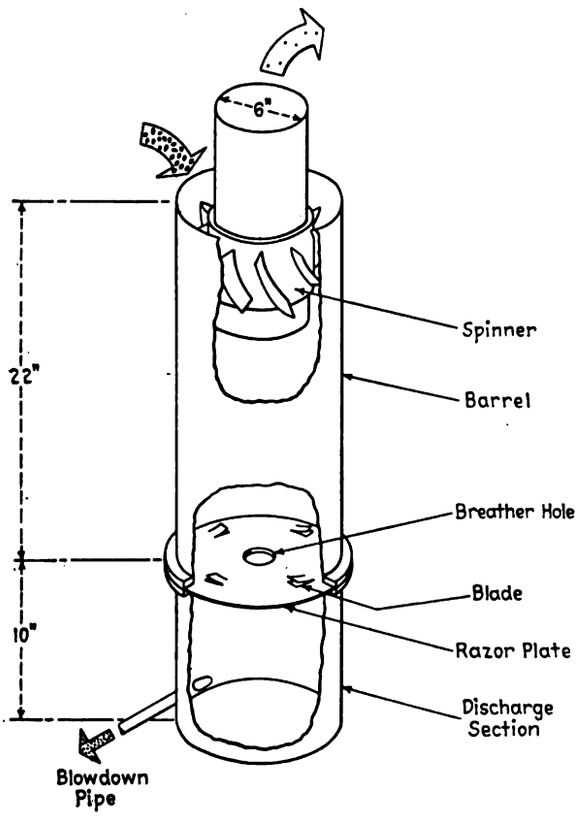
Experience with a full-scale pressurized combustor at Fontana led to the development of the louver separator.* This separator resembles a venetian blind rolled into a cone, with the ash-laden air entering the large end. The air and the finer ash particles can make the abrupt change in direction required to find their way out of the louver, but the larger ash particles and about four per cent of the air pass out through the louver blowdown line.

The louver also serves very effectively to eliminate temperature stratification and to produce a flat temperature profile at the inlet of the main ash separator. The annular burner gives a "hot core" to the air leaving the combustor, and the particles in this core apparently resemble minute eggs in that they are "frozen" on the surface but sticky inside. When these particles impinge on a surface such as the louver elements, they tend to stick. Building up of ash deposits on the louver is the present limiting factor in the operation of the Houdry plant. After 35 to 40 hr. of operation at a fixed firing rate, the louver area becomes restricted to the point where the pressure drop is excessive. When the unit is shut down, the louver cools off quickly and the metal rings shrink much more vigorously than do the ash deposits. Most of the ash cracks off and the remainder is easily removed by hand.

Blowdown Separator

The louver blowndown air must be returned to the separator inlet, because the system cannot tolerate an air loss of anything like four per cent. For this purpose, a blowdown separator has been developed which concentrates the ash into a very small stream of air and returns most of the blowndown flow to the down-stream side of the louver. This separator consists of a 10-in. Dunlab tube mounted within a 20-in. diameter cylinder. The louver blowdown line enters the outer cylinder radially and is given a tangential "kick" by a deflector plate. The air revolves around the inner tube and carries the finer particles through a ¼-in. screen into the Dunlab tube. This tube separates the ash from the air and blows the

* See the May, 1950, *Railway Mechanical and Electrical Engineer*, page 245.



Dunlab Mark II ES2 ash separator

ash out in a 15 cu. ft. per min. stream from the discharge pot. The cleaned air spins back up through the tube and re-enters the main air stream.

The larger ash particles, unable to pass through the screen, drop to the bottom of the outer cylinder where they encounter a tangential jet of cold air. This jet acts by attrition to grind up the larger particles and to carry the resulting finer fragments up through the screen. The cold jet also quenches the burning ash and prevents any serious sintering of the particles which collect in the cylinder. The combination of louver and blowdown separator disposes of the larger pieces of ash. The air stream required to carry the ash away is less than 1/10 per cent of the flow to the louver.

Fly-Ash Separation

Separation of the fine ash particles is an extremely difficult problem. Early attempts to use small diameter cyclone separators for this purpose were defeated because of the combustible nature of the ash. It was learned that a continuous ash discharge was essential with a film-cooled combustor because of the high-carbon content of the ash. For a high-volatile coal a combustion efficiency as high as 95 per cent still leaves about 35 per cent carbon in the ash, which must be cooled below 600 deg. F. before it will cease to burn.

Development of the Dunlab Tube

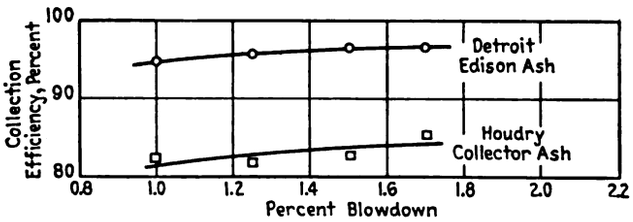
Midway through 1950 it became apparent to the writers and the L.D.C. Steering Committee* that highly efficient ash separation was the paramount requirement in a direct-fired coal-burning gas turbine. Consequently, a separator test stand was erected at the Dunkirk laboratory. Compressed air from the shop line is admitted through a critical flow nozzle which serves the dual purpose of flow measurement and aspiration of the test dust. The dust is fed in measured amounts by a Syntron vibrating feeder salvaged from an earlier L.D.C. project. A gas-fired combustor is used to heat the air to any desired temperature up to 1,400 deg. F.

The objectives of the separator test-stand program were to learn what collection efficiency could be obtained from commercially available tubes operated at high temperature and high air flow and to develop a simple but reliable method of continuous ash discharge. It was also hoped that improvements could be made in separator performance which would reduce the turbine inlet dust loading and positively prevent any plus 20 micron ash from passing through the turbine.

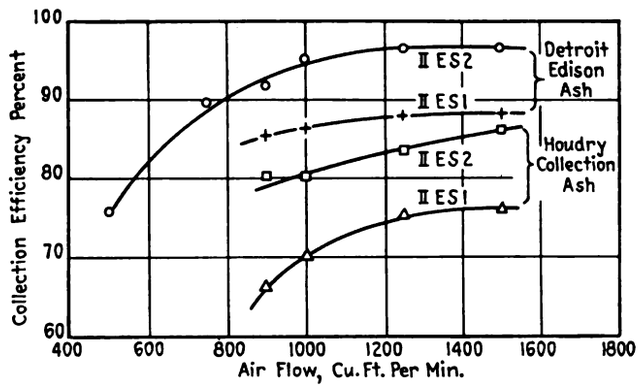
Several types of ash were used. Many of the tests have been run with a Detroit Edison Company fly ash which is available in unlimited quantities and is consistent in its particle size distribution. A number of tests have been run with ash caught by the separator during operation of the Houdry unit. Typical analyses, made with the Roller elutriator, are listed in Table II.

The Dunlab tube, illustrated here, has been investigated in a series of tests in which the tube dimensions were

* K. A. Browne, Chesapeake & Ohio; F. H. Einwaechter, Baltimore & Ohio; C. R. Mabley, Jr., Island Creek Coal Company; E. C. Payne, Pittsburgh Consolidation Coal Company, and C. K. Steins, Pennsylvania.



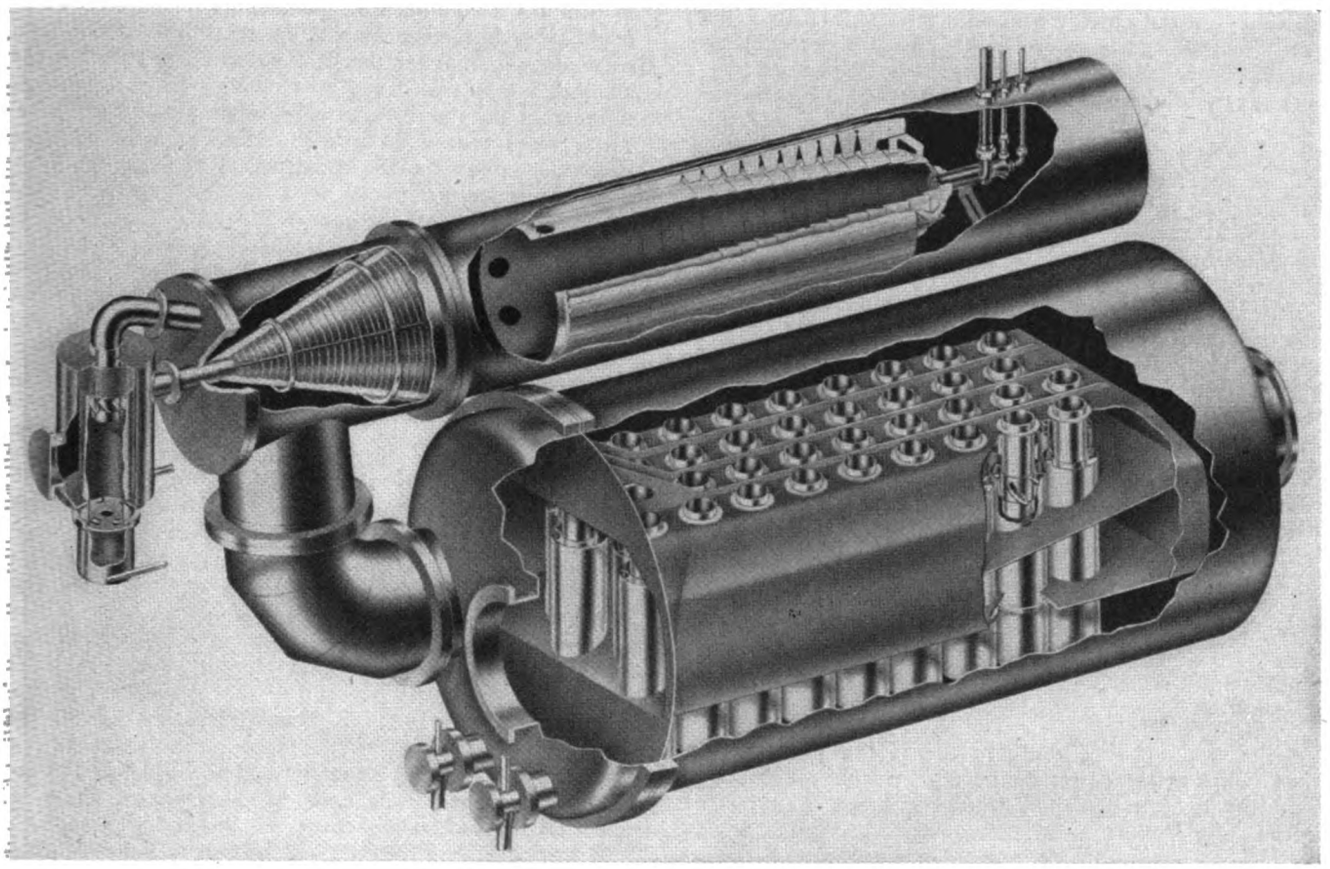
Collection efficiency of the Dunlab Mark II ES2 sparator in relation to blowdown at 1,300 deg. F. and volume of 1,500 cu. ft. per min.



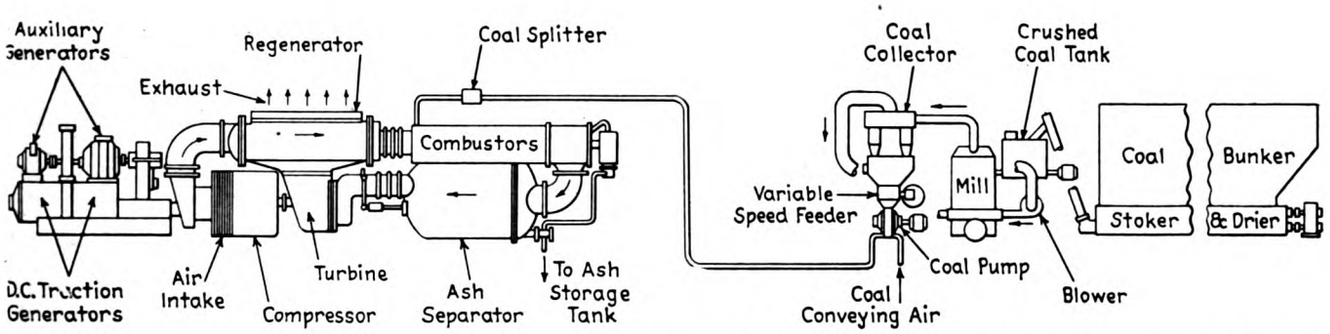
Collection efficiency of the Dunlab Mark II ES1 and Mark II ES2 in relation to air flow at 1,300 deg. F. and 1½ per cent blowdown

TABLE II—SUBSIEVE SIZE ANALYSES OF FLY ASH

Micron Size	Houdry	Detroit-Edison
−10	49.34	20.4
+10-20	30.0	22.9
+20-40	16.3	25.9
+40-80	4.0	22.0
+80	0.36	8.8



The combustion and ash-removal system for the locomotive gas-turbine power plant



Arrangement of coal-handling, combustion and ash-removal equipment for the tests of the Allis-Chalmers locomotive gas turbine at Dunkirk

systematically varied. This tube was evolved after a study of the German literature disclosed that excellent results had been reported by Feifel for cylindrical tubes equipped with iris diaphragm separator plates. The development shown differs from previously disclosed ideas in that it uses blades in the "razor plate" to insure positive and vigorous rotation of the dust-laden air which enters the lower discharge section. A tangential blowdown pipe provides continuous ash discharge.

After preliminary studies had shown that the Dunlab tube had excellent possibilities, tests were carried out to determine the optimum dimensions. Starting with a 10-in. Type VSX Western Precipitation Multiclone, it was found that good results were obtained with the dimensions shown in the drawing on page 52.

Graphs on page 52 show typical test data for both types of dust listed in Table II. It is apparent that collection efficiency increases with air flow up to 1,500 cu. ft. per min. per tube, but the increase is small above 1,200 cu. ft. per min. Efficiency also depends upon the amount of air blown down through the discharge tube. Fortunately, the curve of efficiency vs. per cent blowndown is quite flat above 1 per cent. At 1,500 cu. ft. per min. per tube a blowdown of 15 to 20 cu. ft. per min. is adequate. A velocity of 60 to 80 ft. per sec. is maintained in the blowdown pipe, which is more than enough to convey the separated dust.

After the optimum tube dimensions were determined, the Multiclone spinner was altered by extending the vanes to reduce the exist angle from 45 deg. to 30 deg. This increased the pressure drop by about 30 per cent, but it also raised the efficiency at 1,500 cu. ft. per min. by 8 to 11 percentage points. It is more significant to express the gain by stating that the amount of Detroit

Edison dust *not* caught was reduced from 12 to 4 per cent. With the much finer Houdry ash, the per cent *not* caught was reduced from 25 per cent to 14 per cent.

Analysis of the particle size of the "loss" dust in the cleaned air showed that less than 10 per cent of this dust was larger than 10 microns and only 1 to 2 per cent was larger than 20 microns. Exact determination of particle size in the subsieve range is both tedious and difficult. Microscopic analysis of the plus 20 micron size fraction showed few, if any, particles larger than 30 microns.

The Houdry separator was again modified after 33 hr. of the fourth 250-hr. program had been run. The cones at the bottom of the Multiclones were cut off and replaced by the Dunlab arrangement of "razor plate" and discharge section. Individual blowdown lines were retained with manometers to indicate that each tube was discharging properly.

As this report is being completed, the Houdry unit is again in operation. Dust collection efficiency with the combined louver and Dunlab separator appears to be near 90 per cent, with only about 10 per cent plus-10-micron dust in the turbine inlet air. The dust loading at the turbine inlet is about 15 lb. per hr. in an air flow of 170,000 lb. per hr. (735 deg. F., 30 p.s.i.g.), giving a grain loading of 0.063 grains per cu. ft.

Blade Erosion

From the very beginning of the L.D.C. program in 1945 it has been realized that blade erosion and fouling were the two fundamental problems which had to be solved. The Houdry turbine, borrowed by L.D.C. from the U.S. Bureau of Mines, was used to test the effectiveness of several separators. Four 250-hr. tests have been completed.

The first problem in ash removal was to find a type of separator which would not be burned up by ash containing 35 to 50 per cent carbon. The American Blower Corporation's Type ST-361 was tried first, because of its compactness and its continuous blowdown feature. A separator of this type was built for L.D.C. by the Turbodyne Corporation and tested at Fontana with encouraging results. A similar separator, made entirely of Type 347 stainless steel, was built by Alco Products Division, American Locomotive Company, to L.D.C. designs. This separator was used in the first two 250-hr. tests.

Inspection of the turbine at the end of the first 250-hr. test period showed that erosion was taking place, primarily in the cylinder blading.

After the first 500 hr. of operation the first two cylinder rows and the first rotor row were replaced. The separator was also changed. An 18-tube Multiclone battery was installed with troughs and screws for ash removal. This separator was not satisfactory because of recirculation in the troughs, and very rapid erosion took place. Erosion was still limited primarily to the cylinder blades, although there was some thinning and sharpening of the tips of the rotor blades.

Rotor blading was relatively undamaged in the third 250-hr. test. Few, if any, new nicks were observed in the leading edge of the first row, indicating that the new separator was effectively preventing "rocks" from entering the turbine. The first three cylinder blade rows were again renewed to eliminate any chance of blade breakage and to give a sound basis for comparison of results with the improved separator in the fourth 250-hr. test.

The L.D.C. Locomotive

The objective of the L.D.C. program has always been to produce a coal-burning gas-turbine locomotive which could be used to demonstrate the feasibility of this kind of power plant. After the first year of the program the committee felt that there was enough hope of success to warrant the purchase of a full-scale gas turbine. Contracts were placed both with Allis-Chalmers and the Elliott Company for the construction of 3,750-hp. locomotive-type turbine plants with traction generators and all necessary control equipment.

Construction of the two turbines proceeded in parallel with the development work which has been described in this paper and in previous Midwest Power Conference presentations. * Delays in the research program were closely paralleled by delays and unexpected problems in the designing and building of the two power plants.

In the fall of 1950 enough experience had been accumulated with the Houdry turbine to justify the belief that the locomotive turbines could safely be operated on pulverized coal. Acting as always on the optimistic assumption that the problems would be solved as they arose, full-capacity coal-handling equipment had been ordered from the Read Standard Corporation (formerly the Standard Stoker Company) and a pulverizer had been purchased from the Babcock & Wilcox Co. Erection of a test plant was undertaken, under the supervision of E. L. Cofrances, in a suitable building made available by the Alco Products Division of the American Locomotive Company at Dunkirk. The engineering of the test plant was carried out at the Schenectady office of the American Locomotive Company and construction of most of the components was done in the Dunkirk shops of the Alco Products Division.

A test of 250 to 500 hr. will be run to determine the effect of 1,300 deg. F. air containing —10-micron ash upon the Allis-Chamers turbine. If the results are satisfactory, a series of tests will be run simulating actual locomotive operating conditions.

The operating crew for these tests will be composed largely of engineers assigned by the mechanical department of L.D.C. member railroads. Warner Jamison and Robert Hord, Norfolk & Western; Robert Crouch, New York Central System, and Robert Fort, Illinois Central, have already participated in tests of the Houdry unit and installation of the locomotive power plant.

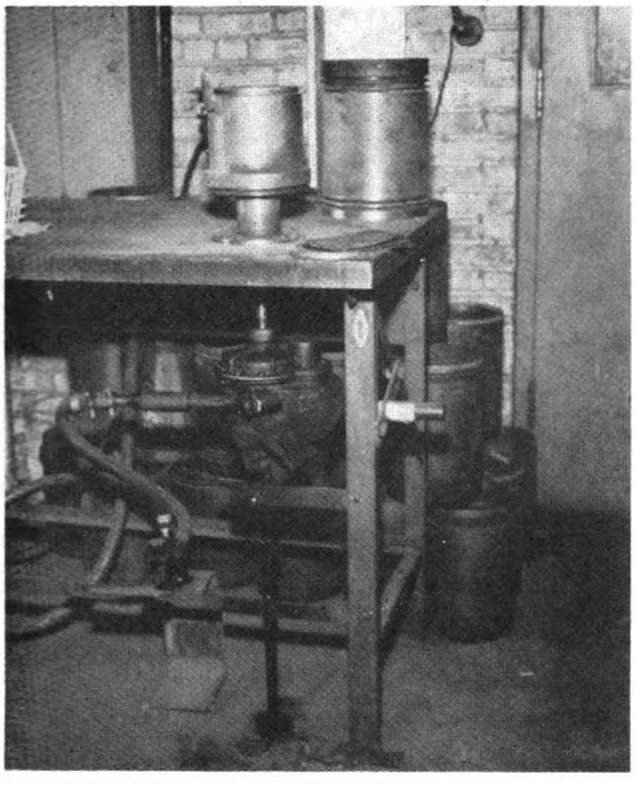
* See "The Gas-Turbine at Dunkirk," beginning page 245, May, 1950, *Railway Mechanical and Electrical Engineer.*

Holds Pistons for Cleaning or Machining

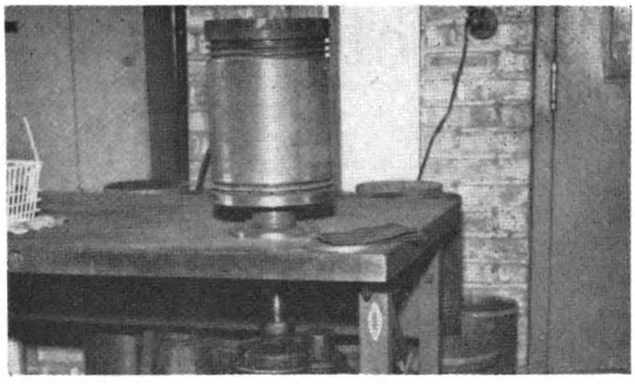
A piston arbor built at the Kinzie street shops of the Chicago & North Western holds and aligns pistons for turning the ring grooves oversize and for cleaning the piston and grooves. The end of the arbor fits into the top of the crown where the piston carrier normally goes. A shoulder on the drive end of the arbor fits the lower section of the carrier. A small ear welded on one side drives the assembly through the ribs in piston top.

The arbor is mounted permanently on a bench for the cleaning operation, and is driven by an air motor. Emery cloth or a wire brush is used to clean the exterior surface of the piston, and a section of a ring to clean the ring grooves.

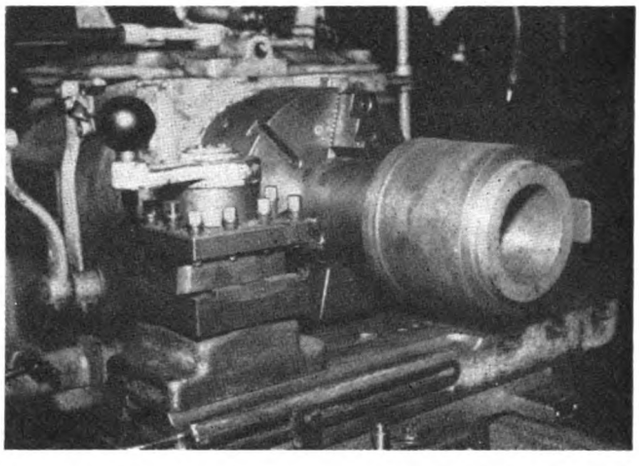
The arbor for turning the ring grooves oversize is identical with the one for cleaning the pistons with two



Arbor to hold pistons for cleaning or for turning ring grooves oversize. In the arrangement for the cleaning operation shown above, the arbor is permanently mounted and driven by an air motor



The arbor with the piston in place showing how the piston fits the arbor



The arbor in place in the turret lathe for turning worn ring grooves oversize. The shank extends through the headstock and aligns the piston as the shank is inserted in place. The drive is by the small ear on the far side of the arbor

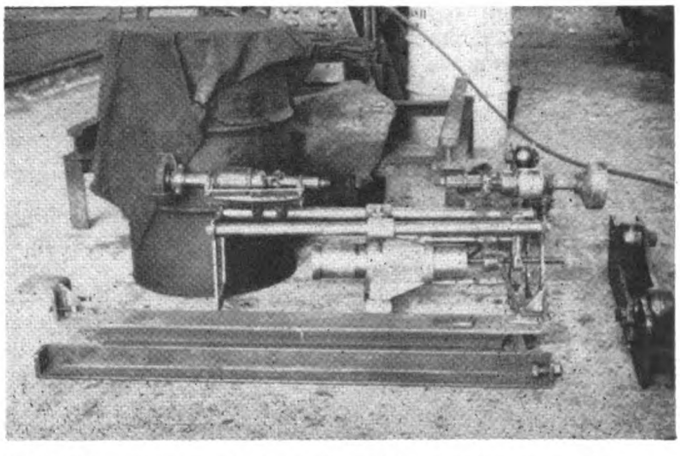
exceptions. The arbor for turning is portable and is placed in a turret lathe only as needed. This arbor also has a shank which fits clear back through the headstock of the machine. With this arrangement, the piston is aligned automatically as the arbor shank is inserted in the lathe; setup time is a matter of a minute or so. The portion of the shank near the piston-holding end is larger in diameter than the rest of the shank, and this portion is clamped by the chuck jaws for rigidity while turning the grooves.

Diesel Wheels Reflanged in Place

Wheels with the flange too high but otherwise OK can be restored to permissible contour in 3 to 4 hours without removal from the locomotive by an arrangement built by the Belt Railway of Chicago.

The first step is to fasten the rollers shown at the right in the illustration to the rails of the pit. The roller stands on the opposite sides of the pit are connected and secured to each other by the angle iron in the foreground. The brace, shown immediately behind the angle iron, rests on the rails and is secured in place by the two set screws on each end. This brace supports a pair of crank pin grinders used to cut the scale before machining.

The high flange is cut down by a form tool which is supported in a holder bolted to the roller stand. Feed is by hand screw. During the turning operation the wheels are revolved by the traction motor, the power being supplied by an electric welding machine.



With this arrangement wheels do not have to be removed from diesel locomotives to correct high flanges. On the right is one of the two roller stands which support the pair of wheels to be re-flanged and which holds the form tool. The crank pin grinders remove the scale

Hot Boxes— Causes and Remedies*

By Arthur H. Keys†

THE latest available data compiled by the Mechanical Division of the Association of American Railroads reveals that an average of 17,500 freight cars were set off each month between division terminals on all roads during the last five months of 1950, and while a month to month improvement is indicated, as warm weather subsides and we go into the fall and winter months, this improvement is termed seasonal.

It is interesting to note that the larger percentage of cars set off between division terminals are foreign cars—cars not owned by the handling road. For the last six months of 1950, foreign cars represented 77 per cent of the total cars set off. This would indicate that system cars are being given more attention than are foreign cars.

This is no doubt due to the failure of the receiving roads to allot sufficient time to the box packers or interchange inspectors to go over the boxes, examine them and set up the packing before dispatching the cars in freight trains.

The Baltimore and Ohio Railroad, since 1942, has greatly reduced the number of freight cars set off between division terminals account of hot boxes. For the year 1942, 5,520 freight cars were set off due to hot boxes, 3,232 of which were foreign cars and 2,288 were system cars. The average mileage per car set off was 276,511 miles. During the year 1950, a total of 2,222 cars were set off, 1,697 of which were foreign cars and 525 of them system cars, and the average mileage increased to 558,769.

There were many factors contributing to this improvement. Some was due to better truck maintenance on system cars; better attention given to cars received in interchange before allowing them to depart over the initial division, and by giving journal boxes attention at intermediate terminals.

We have made no radical change in our materials, such as journal bearings, cotton packing or oil, but we did improve our shop practices giving closer attention first at the wheel shop where wheels are mounted, or where treads are turned, or the journals are trued. This, in some cases, required repairs or replacement of our wheel shop equipment to bring it within the tolerances specified in the A.A.R. Wheel Shop Manual. Renewal or repairing journal bearing wedges that were found to be flat or distorted was another important step which was found essential in starting the car out of the shop in proper condition for service. Strict compliance with the A.A.R. Standard Practices in connection with the saturation and preparation of journal packing, and by educating the men selected to repack journal boxes as to the proper method of doing their work is essentially important.

While cars are in the shop for heavy repairs, all parts of the truck are dissected and the dust guards renewed regardless of their condition. The renewal of dust guards in itself insures that the truck is completely dismantled and this insurance is quite economical, even though a good dust guard is occasionally found.

At interchange points inspectors must inspect the journal boxes immediately on receipt of the cars from connections. Many boxes, which are running above normal temperature, can be detected at this time and the bearings removed. And, in many cases, the cause of heating will be found to be waste grab. This condition cannot ordinarily be detected after the box has cooled down. Each of these cases is a potential hot box and may require setting the car off on the line of road.

Instructions in the Wheel and Axle Manual effective February, 1951, contain many new recommended practices which *should* be followed and many mandatory rules which *must* be followed. An additional requirement has been added in Section 20—Mandatory Rules covering wheel shop practice relating to the use of magnetic particle testing of axles. Under Paragraph 355, Section 20, covering Axle Lathe Practice, Section 0 requires that in addition to Magnafluxing all journal surfaces having any discoloration due to overheating, or if any circumferential checks or cracks are found, which cannot be turned out without going below the condemning limits, all mounted wheels removed from cars must be magnetic particle tested before being returned to service.

This is an excellent rule and one, if complied with, will reduce the large number of broken or burned off journals which are occurring due to fractures and copper penetration at the time of previous heating. Occasionally a journal will break off without showing any discoloration or without heating. In the majority of cases copper penetration up to an inch or more will be found in the broken part. The test laboratory has no difficulty in determining, beyond any question of doubt, that the journal failed due to a crack which had its inception at the time of previous heating and which apparently was not detected at the wheel shop before the wheel was returned to service. There are a large number of failed journals that break off showing a straight break with copper penetration, even though they show to have been heated to some extent at the time of accident but not sufficiently heated, in the opinion of the wreck master, car department and operating officers, to term them burned off journals. In many cases there is no taper of the end which broke off, although the stub is badly distorted from contact with the journal box. When such journals are analyzed by the test department the cause is usually attributed to overheating, although the test department cannot definitely say that the fracture and the copper penetration did not take place during the previous hot box.

I have purposely elaborated on this subject as it is important to comply with the instructions contained in

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* A paper presented before the Eastern Car Foremen's Association, New York, April 13, 1951

† Superintendent Car Department, Baltimore & Ohio

Paragraph 355 of the Wheel and Axle Manual relating to the magnetic particle testing of all journals at the Wheel Shops. If only a single fractured journal is detected by the Magnafluxing method it may prevent a costly accident and serious disruption of railroad traffic.

Sufficient qualified employees should be available at intermediate terminals, where engine and train crews are changed, fill-outs made, and where a terminal air brake test must be made before the train again departs. It is important that this intermediate attention be given and, while the terminal operating officers will be reluctant to hold the train a few minutes longer to enable the car department to perform this work, we have convinced our operating department it is much more economical to hold a train in a terminal a few more minutes than to delay it on the line of road setting off cars. We attribute much of our hot box improvement to the cooperation we are receiving from our operating department.

Passenger Cars

Hot journals on passenger cars are more annoying than on freight cars. When it is necessary to set a car out of a train, the passengers must be transferred to other equipment, including those who might be asleep. There is also a possibility of a burned off journal if it is not discovered by crew or some other employee.

The same precautions as recommended on freight cars are applicable to passenger cars. Boxes must be repacked periodically, after a careful examination is made of the bearings, wedges and dust guards. A thorough repair job must be made when a car receives classified repairs or when it is in the terminal for servicing. At intermediate points, where time permits, the box lids should be raised and packing adjusted when necessary. Where time does not permit raising the lids an inspector should feel each box with his bare hand and any box found running above normal temperature should be further inspected to determine the cause.

In 1942, we obtained a mileage of 497,054 miles per hot box on passenger cars. This included system and foreign cars. In 1950, a mileage of 4,236,370 miles per hot box was obtained.

While some of the improvement made can be attributed to the use of roller bearings on passenger cars, it is just as important, if not more so, to know that roller bearing boxes are maintained to the highest degree of perfection and that they have sufficient lubrication in them to function properly. When a roller bearing box starts to heat, we find ourselves in a rather helpless position. Nothing can be done except to set the car out of the train, remove the wheels and boxes and forward them to the shop for further examination.

We recently had two roller bearing failures that were caused by a kinked cover gasket, a kink only large enough to permit a drop of oil at a time to leak out of the box and be blown away; yet when the boxes burned up it was due to the loss of all of the oil. It is important that the cover gasket be uniformly applied under the lid. Cap screws are generally used in roller bearing boxes which makes it impossible to center the gasket on the box before applying the cover, and carelessness on the part of the employee applying the cap screws often results in the gasket failing to properly seal. To overcome this, four dummy studs are provided at our shops and terminals, which insures the gasket being properly applied. After the cap screws are located in the other bolt holes and dummy studs are removed and the remaining cap screws applied. This has greatly improved our gasket leakage.

Another roller bearing failure occurred because one of our wheel shops, after making a thorough examination of the bearing, at wheel change, failed to refill the box with grease; the terminal, assuming that the wheel shop had done the work, allowed the car to go forward. The result was overheated bearings.

We cannot reduce hot boxes by looking over the monthly reports issued by the Mechanical Division showing the mileage made per hot box set off and feel satisfied that the mileage on our own railroad is greater than on a neighboring road. We must do something about it and convince ourselves that we are doing everything that can be done to lick the problem—first by doing a first class job when a car is in the shop; second, by giving journal boxes attention before starting the car out on its run; third, by setting up the packing at intermediate points where the train stops to change crews.

Engineers have attempted, for many years, to develop devices to prevent or reduce hot boxes. There are a number of excellent devices, some of which have been approved, that have been helpful in preventing hot boxes. For several years we experimented with packing retainer springs in our passenger cars. These were designed to hold the packing in place, to keep it from turning up against the journal bearing and allowing waste to enter between the journal and the bearing, causing waste grabs. Their use was so successful on our passenger cars that they have been adopted for use on our freight cars.

However, this is not a cure-all. You cannot simply place a packing retainer spring in a journal box and forget about it. It must be removed periodically, the packing set up and the spring replaced.

For many years a rubber pack has been under test which fits in the bottom of the journal box. It is filled with oil saturated waste. This pack hugs the side of the journal in such a way as to prevent the waste getting up under the bearing. While this pack is still in the test stage, the results obtained have been gratifying, and we will no doubt hear more about it in the months to come.

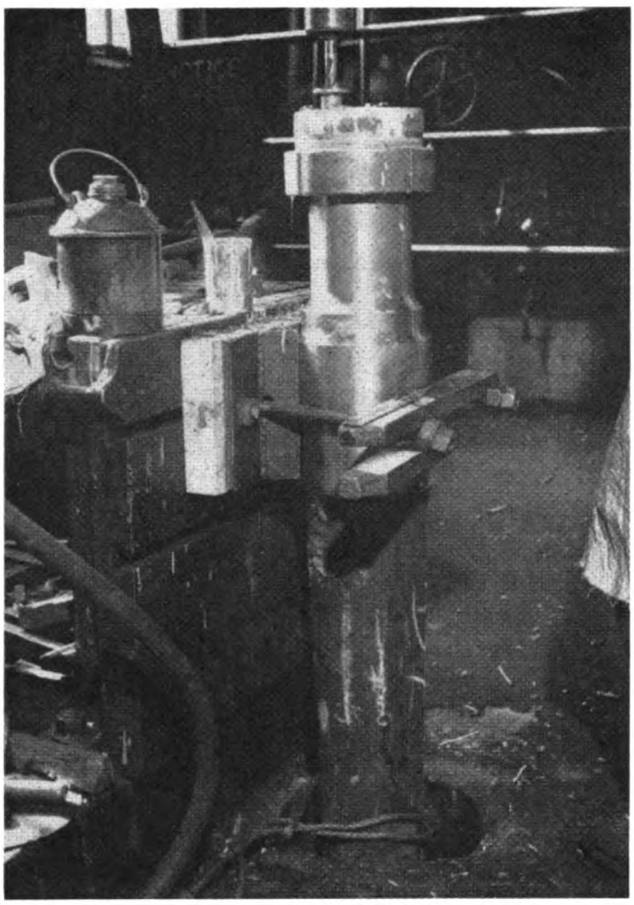
The substitution of felt pads for cotton or wool waste has been tried and found to have considerable merit. We have a number of passenger cars equipped with such a device, which is giving excellent service. One of the passenger cars has been in daily service between Jersey City and Chicago for the past 30 days, and the results obtained have so far been satisfactory.

The action of the A.A.R. Committee on Lubrication of Cars and Locomotives in modifying A.A.R. Interchange Rule No. 66 to provide more frequent time periods for periodical attention to journal boxes so as to improve the lubrication performance of cars was, in our opinion, an excellent decision and will go far in reducing heated journals.

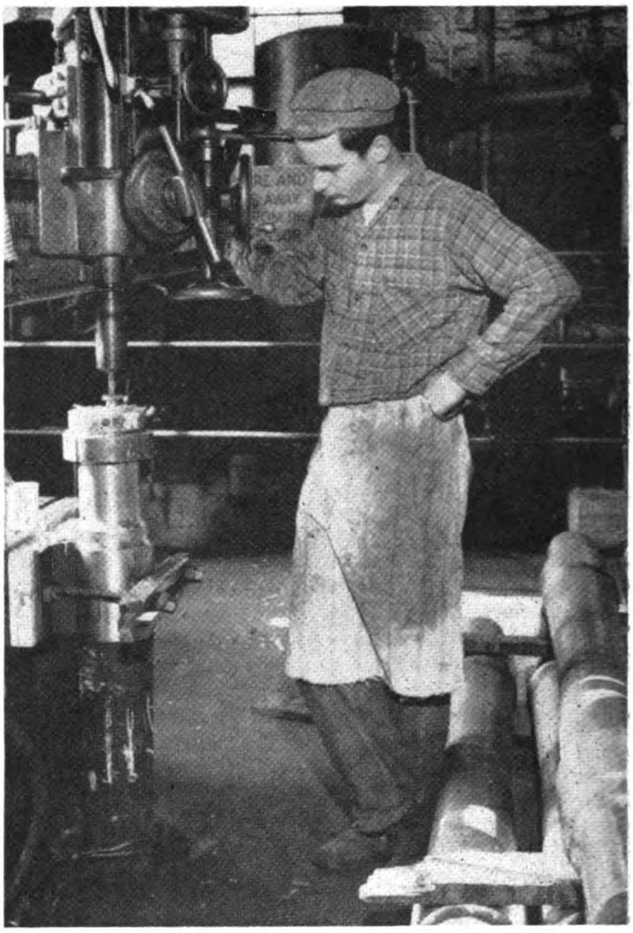
Holding Fixture Minimizes Set-Up Time

A radial drill press has been adapted, by means of an auxiliary holding fixture, to a variety of jobs ranging from drilling the end of axles to refacing Vapor steam-hose joints, the latter with the aid of another jig that bolts on the top of the drill press table. The clamp was developed at the Bloomington, Ill., shops of the Gulf, Mobile & Ohio, and it is used principally for drilling and tapping the end cap holes on roller bearing axles.

The holding arrangement consists essentially of a hole



The holding fixture. After the first axle is aligned with a level for drilling by adjusting the back stop the remainder are automatically aligned because the top remains fixed



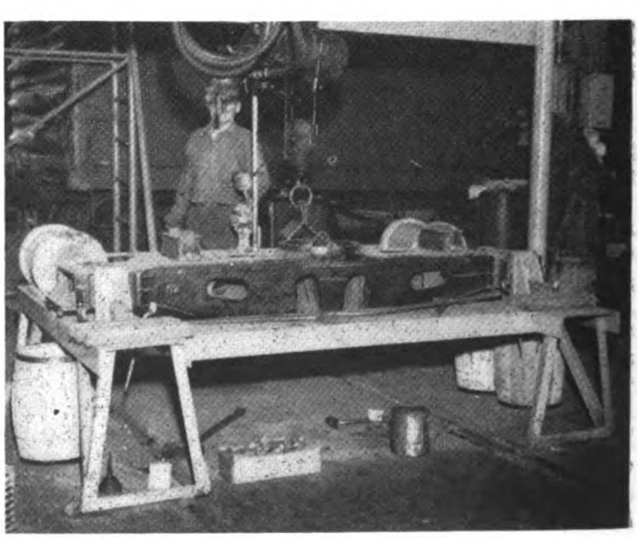
Drilling the end cap holes for roller-bearing axles on a radial drill press with an auxiliary axle-holding fixture

in the floor, in which one end of the axle rests, and a clamping arrangement at the wheel seat portion of the axles for securing the axle in place. The advantage of the arrangement lies principally in eliminating all set-up time after the first axle. This first axle in a lot is set up with a level by adjusting the back stop of the holding fixture, which is mounted on the bed of the drill press. From then on remaining axles are merely clamped in place as the back stop remains in a fixed position. The axle ends are laid out for drilling and tapping the three holes by a drilling jig with a screw chuck that fits over the journal.

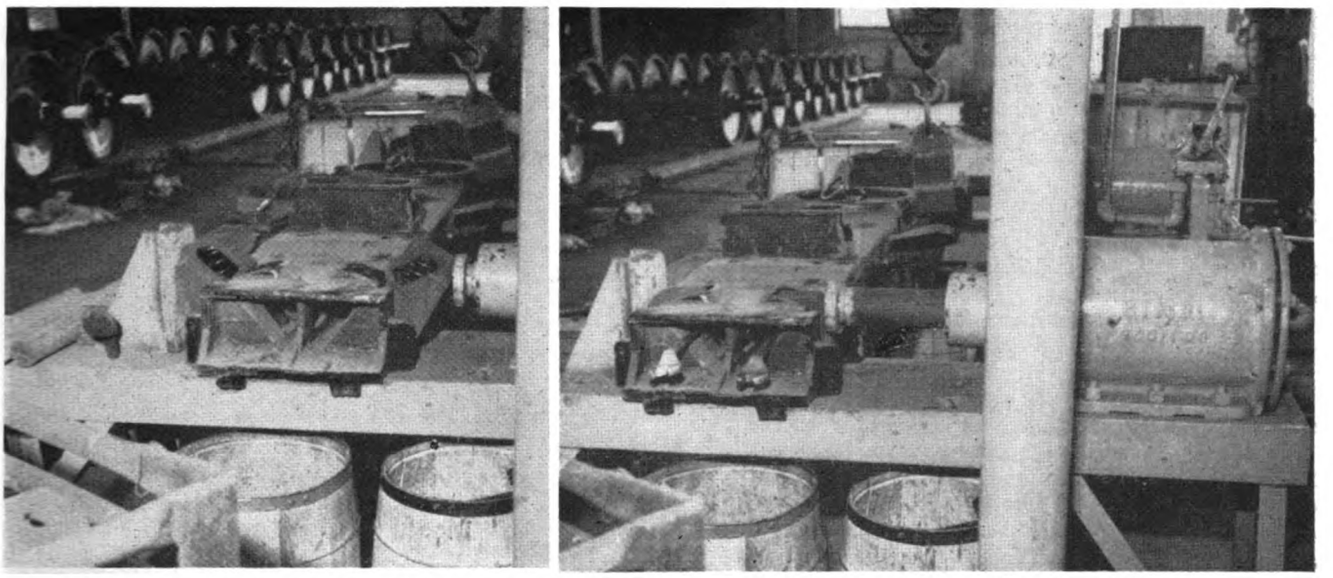
Compressing Freight Truck Friction Shoes

The friction shoe springs on A.S.F. Ride Control trucks are easily compresesd to permit final assembly of the bolster to the truck side frames by an arrangement developed at the Chicago & Eastern Illinois Oaklawn shops in Danville, Ill. The compressing device consists essentially of a frame on which the bloster is mounted and two air cylinders for squeezing the friction shoe springs.

The bloster is set on the frame, and the friction shoes, or wedges, and the springs are placed in the proper position. Air is admitted simultaneously to the two cylinders to compress the friction shoe springs. The spring and wedge assembly is then held in the compresesd position



Arrangement for compressing the friction shoe springs on A.S.F. Ride-Control trucks to permit application of the bolster to the truck side frames

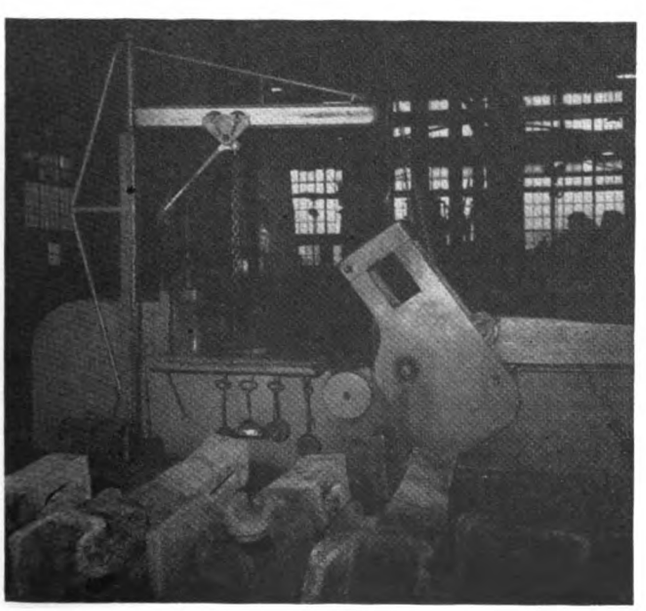


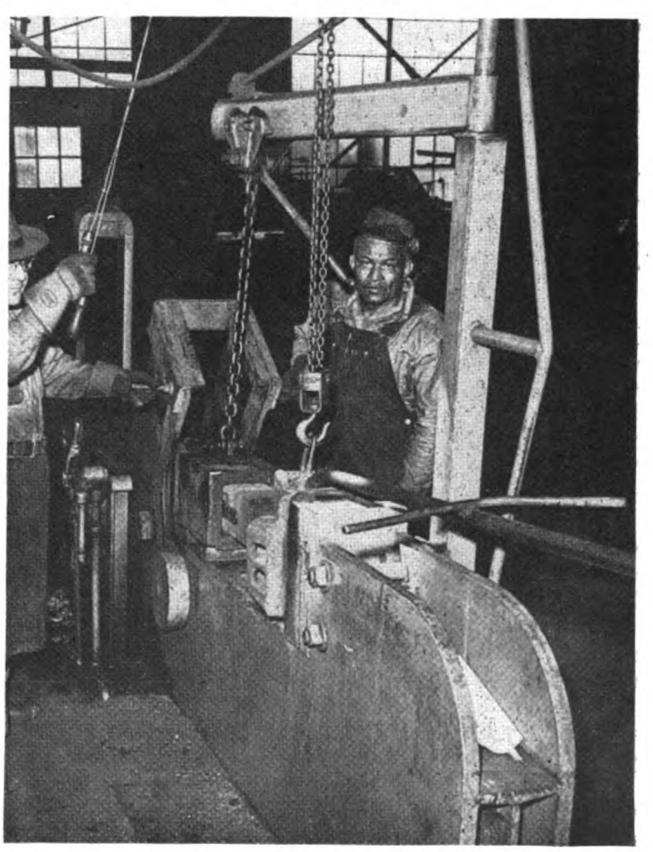
Left—The bolster with the snubbing device in place preparatory to having the springs compressed. Right—When air is admitted to the cylinders, the friction shoe spings on both sides of the bolster are compressed simultaneously, and the springs are held in the compressed position by wrenches with pointed ends

by pointed-end wrenches until the bolster is applied to the truck side frames. When the truck is assembled, the pointed wrenches are removed by prying up on the top of the casting with a 6-ft. steel lever; this applies pressure on the top of the shoe to compress the spring sufficiently to permit the removal of the wrench by hand.

Freight Car Coupler Reclamation

When key slot in the butt end of Type D and E freight car couplers has worn elongated from service, the coupler can be reclaimed for about one-tenth the cost of a new one by the procedure employed by the Southern at Spartanburg, S. C. The butt end of the coupler is heated to between 1,750 and 1,800 deg. F. and a standard key inserted in the slot. A sleeve is applied over the butt end of the coupler placed in an air press where the keyway





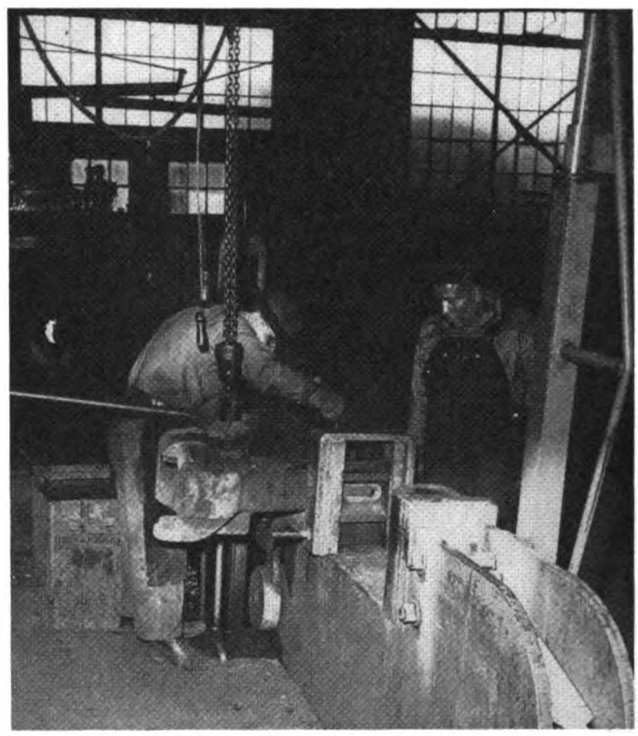
Above—A coupler in place preparatory to shortening key slot.

Left—Equipment for returning to standard dimensions key slots in type D and E couplers which have worn elongated in service

is shortened back to A.A.R. standard length. The reduced overall length of the coupler which results from the slot shortening operation is compensated for by welding a plate on the butt end to return to standard the length between the butt end and the horn of the coupler. The die on the air press is so designed that in shortening the keyway the butt end is also squared at the same time to receive the plate which is later welded on. After the plate has been welded in place the entire coupler is normalized at 1,500 to 1,550 deg. F. for one hour per inch of thickness.

The sleeve which fits over the coupler is made of 1⅝-in. plate, 7½ in. deep and generally shaped inside to fit the coupler. The opening of the sleeve is enlarged at the entrance, and part of the key protrudes beyond the entrance so that the workman can observe when the key fits tight in the slot to terminate the shortening operation. The blind end has a 2-in. hole into which a 2-in. round projection of a false bottom fits. This false bottom of 1-in. plate is used to drive the coupler out of the sleeve after the shortening operation with the ram of the air press. A second heading plate pushes the key out of the slot, power for this operation again being supplied by the air press ram.

Shortening is done with a steady force of 145 tons supplied by a vertical air cylinder 20 in. in diameter with a 30-in. stroke through a lever 55 in. long. One end of the lever is 3 in. thick and 10 in. deep and gradually tapers to 2¼ in. thick and 7 in. deep at the other end. The fulcrum is 8 in. from the point of transmittal of the force, or 47 in. from the point of application of the force. The back stop is shaped to mate with the pulling face of the coupler. The stripping piece which holds the coupler for removal of the key is made of 1-in. plate with an opening 7¼ in. by 10¼ in. and with an inside width of 8⅝ in. The main frame of the press is built around an I-beam 7 in. by 24 in. covered with a 1⅜-in. plate.



How the dummy key is removed from the slot after the shortening operation

Heavy-Duty End and Side Straightener

The most stubborn car ends and sides can be straightened with a portable device used at the North Western's Proviso, Ill., car shop. The straightener consists essentially of a removable 50-ton air jack, a 5 in. by 8 in. oak timber which transmits the force of the jack to a length of 2- or 3-in. pipe which fits in the corrugations of the ends, the necessary frame for holding and transporting the jack and timber, and a pair of ratchet hand brake wheels, one for applying and removing the jack, the second for adjusting the oak timber. Means are provided for securing the device to the car coupler, and there are a variety of special hook arrangements to secure the straightener to the bolsters, the side sills or the end sills when desired.

Bulges in the ends near the center are corrected by securing the straightener to the coupler by the knuckle pin with the knuckle removed. For end bulges near the sides of the ends, the straightener is secured to the end sill by one of the special hooks, which are also used to secure the device to the bolster or side sill when straightening the sides.

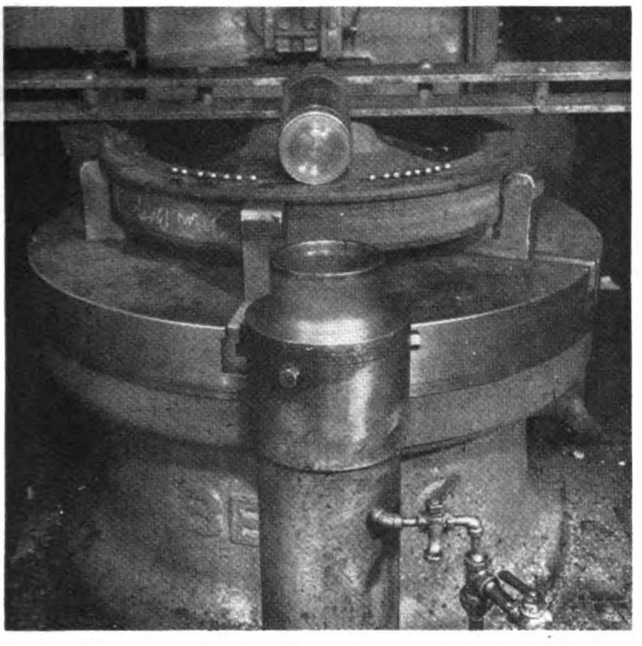
In all these operations the framing of the straightener is supported on blocks so that the reaction from the application of the straightening force does not break the wheels and axle.



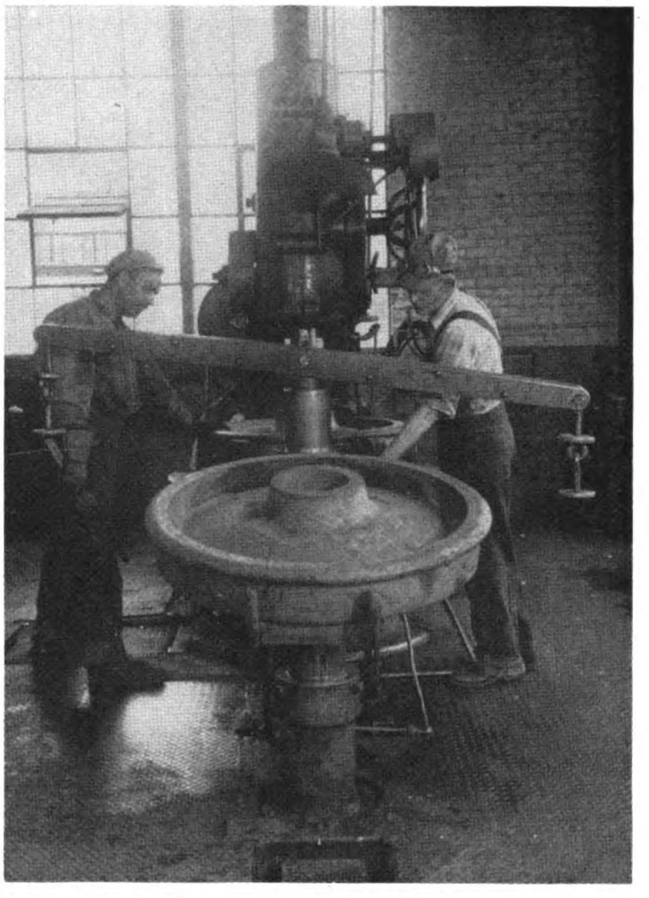
Modification to Duplex Wheel Loader

A typical duplex wheel loader, shown in the illustration, has been modified to permit shortening the arm by 2 ft. while at the same time easing the task of swinging the arm. By reducing the turning effort required, the arm length has been shortened to a little under 6 ft. to permit this type of loader to be used in areas which formerly were too small to allow such installations.

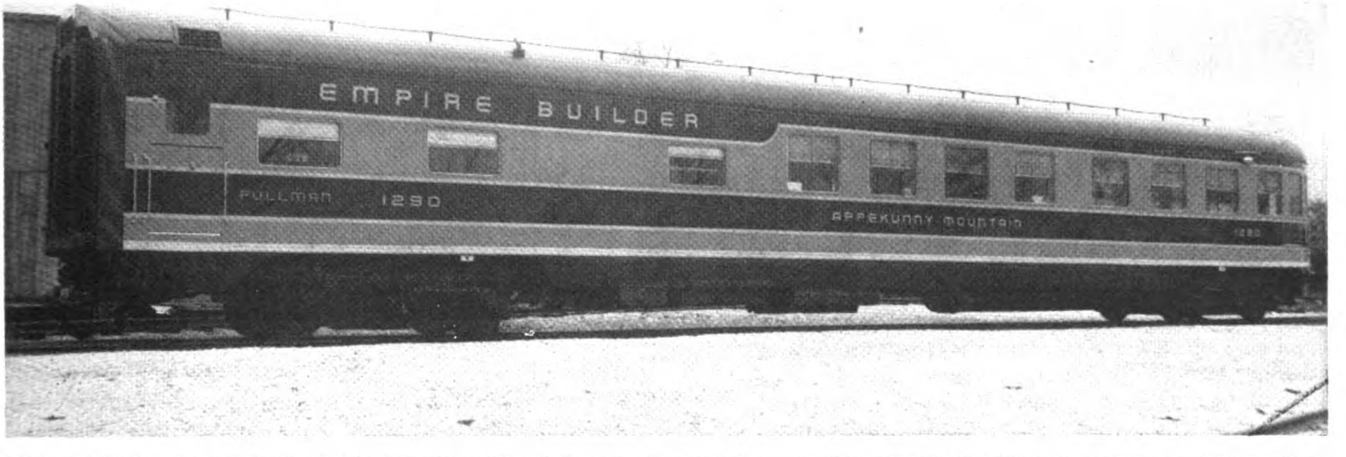
Turning has been made easier by incorporating a ball bearing ½ in. by 4½ in. in an opening bored in the ram, which does not turn. The ball-bearing installation reduces friction and permits easier turning than where the ram itself has to turn while supported by air pressure underneath. The shorter arm also saves several steps each time wheels are loaded or unloaded.



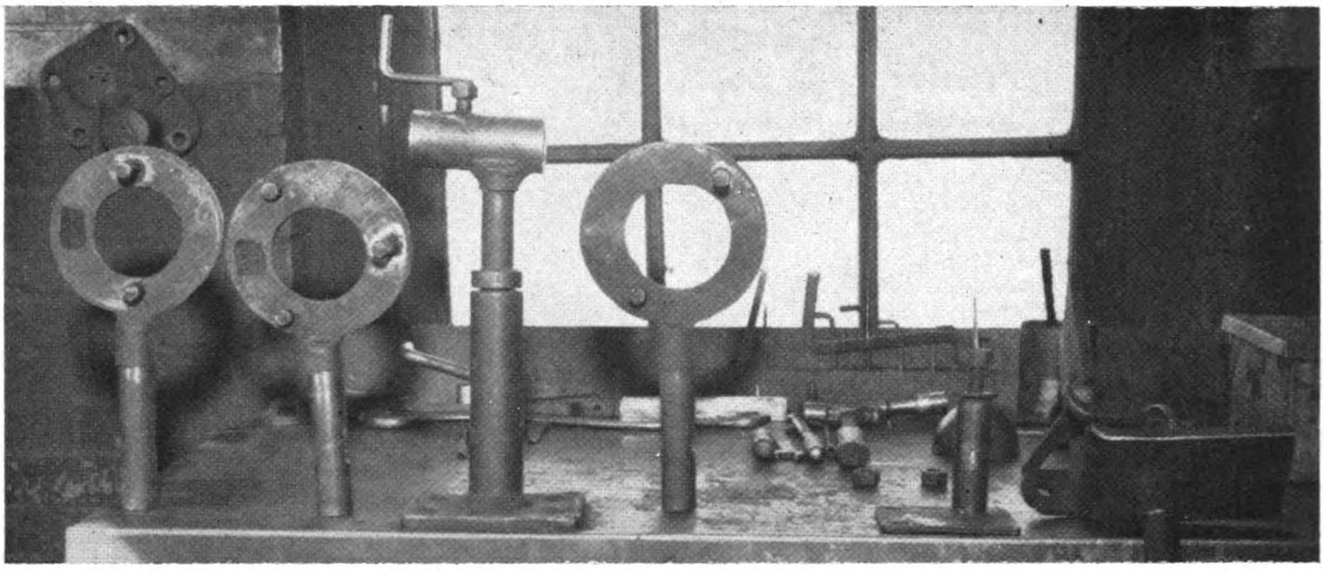
By incorporating the ball bearing in an opening bored in the ram, the ram does not have to turn while supported by the air pressure underneath

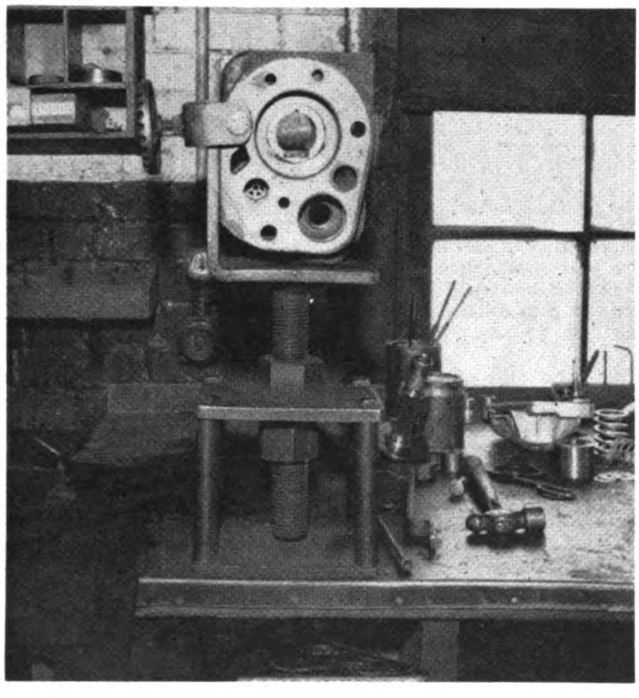


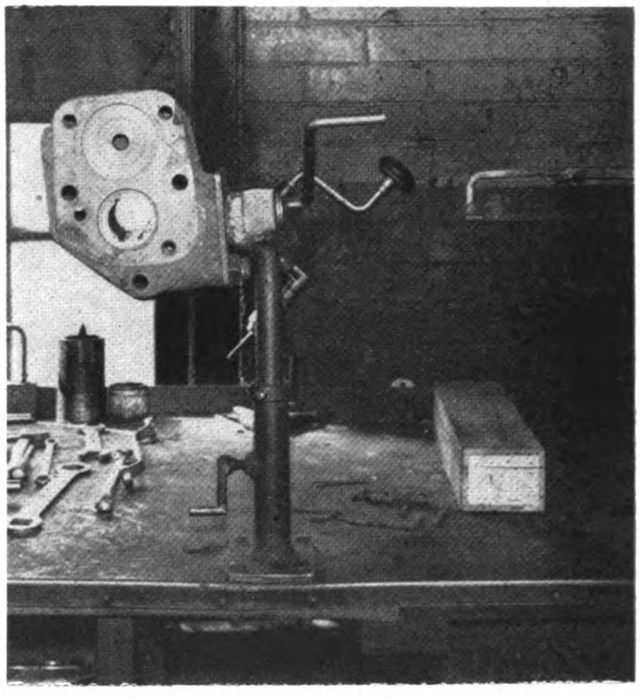
Because the ball bearing reduces the friction necessary to turn a pair of wheels on either end of the duplex loader, the arm can be shortened to allow the use of this type of loader in areas that otherwise would be too small



Observation-lounge car built by the American Car & Foundry Co. for the new "Empire Builders" of the Great Northern which went into service on June 3. The exteriors of the cars for these trains, which were built by the American Car & Foundry Co. and the Pullman-Standard Car Manufacturing Company, are orange, with olive green skirt, letterboard, roof and ends. Gold striping above and below the windows and the gold lettering is Scotch-Lite.







Holding Stands for Air Brake Parts

The illustration at the top of the page is of an air brake holder which will hold service and emergency portion of AB brakes as well as K1 and K2 freight triple valves and L2 and L3 passenger triple valves. From left to right, the adapters are for K1 triple valves; K2 and L2 valves; L3 valves, and AB portions.

The lower illustration at the left shows a holding stand for emergency portions of AB brakes. The portion is secured in place by slipping the pin through the clamp and tightening the hand wheel. The stand can turn a full 360 deg. and is locked in any position by a nut on the bottom.

The illustration at the top of the page is of an air brake reconditioning AB service portions with permits pivoting about either a horizontal or vertical axis. Tightening the upper crank handle locks the portion against pivoting about its horizontal axis, and tightening the bottom crank locks the stand against pivoting about the vertical axis. The service portion is held to the stand by two bolts which fit through two holes in the adapter plate and two holes in the quick service limiting valve cover.

These devices are in use at the Oelwein, Iowa, shops of the Chicago Great Western.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Cylinder Heads and Valves

234-Q.—How are the exhaust and inlet connections made to the head? A—The exhaust manifold is clamped to the cylinder head by means of two clamps. The air or inlet connection is an integral part of the head, connecting directly to the air manifold. The joint is sealed by a special gasket and pressure exerted by cylinder head.

235-Q.—Where is the injection nozzle located and how is it fastened? A—The fuel injection nozzle is located in the center of the head and is held in place by a two stud clamp.

236-Q.—Where is the high pressure fuel injection line located? A—It enters the forward part of the cylinder head from the individual fuel pump through a grommet and on to the injection nozzle.

237-Q.—What provision is made for a leak off from the nozzle? A—It is piped directly to a drain header.

238-Q.—How is the cylinder head cooled? A—With water flowing into the head from the cylinder liner jacket and out throug the water outlet manifold.

239-Q.—What assembly is mounted on the head? A—The valve levers and equalizing yokes are mounted on the valve lever bracket which carries the valve lever shafts. The equalizer yokes are guided on the yoke guides which are pressed in the head. The lever assembly is removed from the head as a complete assembly and is totally enclosed by a light weight cover when the head is complete-assembled.

Diesel Engine Piston, Piston Rings and Pins

240-Q.—What type of pistons are used? A—Aluminum alloy.

241-Q.—How many compression rings are applied? A—Three.

242-Q.—What other rings are used? A—Three oil control rings.

243-Q.—Where are the oil control rings located? A—One above and two below the piston pin.

244-Q.—How is the piston cooled? A—By oil received through the connecting rod from the crankshaft.

245-Q.—How is the oil circulated? A—From the crankshaft it passes up the rifle drilled connecting rod, through the hollow piston pin, to special oil circulating passages in the piston.

246-Q.—Where does the oil go from there? A—The hot oil is returned to the engine base through a discharge hole in the piston.

247-Q.—Where is the piston pin bearing applied? A—It is pressed into the eye of the connecting rod.

248-Q.—What kind of a fit is used for the piston pin? A—It is a hand push fit in the piston and a running fit in the connecting rod.

249-Q.—How are the piston pin plugs applied? A—They are a press fit in the piston.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel elec. locomotives.

Steam Locomotive Boilers

By George M. Davies

How Big Should a Rivet Be?

Q.—How is the diameter of the rivets of a locomotive boiler determined? The recommended practices for rivet sizes for various thickness of plate is standardized and universally used. What I would like to know is how the individual rivet size is determined?—B.V.C.

A.—The theoretical or critical diameter of the rivet is based on the possible failure of the rivet. The rivet can fail in either of two ways, namely by shearing or crushing. The formulae for rivet failure due to shearing and crushing is as follows:

(1) Resistance to shear $= \frac{\pi d^2}{4} fs$

(2) Resistance to crushing $dt\,fc$

where

d = diameter of rivets in inches

fs = 44000 pounds per square inch for Steel Rivets in Single Shear.

= 88000 pounds per square inch for Steel Rivets in Double Shear.

fc = 95000 pounds per square inch of projected area in steel plate.

t = thickness of plate in inches.

From the above formulas it will be noted that for a given plate thickness the shearing resistance of a rivet varies with the square of the diameter while the crushing strength varies with the diameter of the rivet. The critical diameter of the rivet for a given thickness of plate is where the strength of the rivet is the same for either method of failure.

To find this critical diameter for a given plate the formulas should be equated

Thus

$$\frac{\pi d^2}{4} fs = dt\ fc$$

$$\text{or } d = \frac{4t\ fc}{\pi fs}$$

By substituting values for (t) in the above formulae the critical diameter of rivet for each thickness of plate can be determined. Rivets smaller than the critical diameter fail by shearing and those larger by excessive bearing pressure.

Drilled Holes in Throat Sheet Cracks

Q.—In applying outside throat sheet patches, it is our practice to vee out the crack and weld the throat sheet prior to the application of the riveted patch. With this procedure is it necessary to drill a hole in the throat sheet at the end of the crack prior to welding the crack?—M.T.Z.

A.—This apparently is a carry over from the practice of drilling a small hole at the end of a crack, to prevent the crack from extending, before applying a riveted patch. It would appear that with the crack vee'd out for welding it should not be necessary to drill holes to determine the ends of the crack.

Locating the Bottom Gage Cock

Q.—Our electric locomotives are equipped with 40" diameter vertical firetube steam heat boilers. On this type of boiler how is the location of the bottom gage cock above the firebox tube sheet determined?—C.C.P.

A.—The bottom gage cock of a vertical firetube boiler is located not less than two inches above the danger line. The danger line is located, not less than one-half the distance over the tube sheets, above the firebox tube sheet. Thus for a vertical firebox boiler having $35\frac{7}{8}$ inches over tube sheets, the danger line would be $17\frac{15}{16}$ inches above the firebox side of the firebox tube sheet and the lowest gage cock would be located at least $17\frac{15}{16}$ inches plus 2 inches $= 19\frac{15}{16}$ inches above the firebox tube sheet measured from the firebox side of the sheet.

The I.C.C. Rules governing the inspection and testing of locomotives, other than steam provides as follows:

Rule 317 (a) Every steam boiler shall be equipped with at least one water glass, and three gage cocks which can be easily opened and closed by hand. The lowest gage cock and the lowest reading of the water glass and the line on the badge plate shall correspond and be not less than two inches above the danger line. The danger line shall be that at which there will be no danger of overheating any part of the boiler. The danger line for vertical firetube boilers shall be not less than one-half the length of the tube above the lower tube sheet: and for vertical submerged tube boilers, the upper surface of the top tube sheet.

Schedule 24 RL
Air Brakes

TRAIN CONTROL OPERATION (*continued*)

1141-Q.—To where does the charging air from the N.S.1-reducing valve flow? A.—Through the strainer and pipe *1* to the timing valve.

1142-Q.—What does the timing valve consist of? A.—A pipe bracket *(2)* on which is mounted magnet *(234)* for receiving the train stop or cab signal indication, the timing valve portion *(80)*, with its control piston *(90)* and valves *(82)* and *(83)* for operation of the brake valve service application piston, a signal whistle which blows when the timing valve operation is initiated and the safety valve *(38)*, which protects the timing valve against excessive pressure. Ball check valve *(27)* with choked bushing *(25)*, which permits quick charging of the chamber below piston *90*, but restricts flow in the reverse direction to the desired amount.

1143-Q.—When is the timing valve magnet energized? A.—When the system is charged and the signal does not call for a train control application.

1144-Q.—What happens when the magnet valve is energized? A.—Upper exhaust valve *240* is moved down on its seat to cut off the exhaust and lower valve *243* is unseated.

1145-Q.—What is the result of this movement? A.—Reducing valve air is permitted to flow past ball check *27*, which is unseated, and the chamber below piston *90* is charged.

1146-Q.—What is the result of charging the chamber below piston 90? A.—The piston is moved to its upper position.

1147-Q.—What is accomplished by the upward movement of piston 90? A.—The upper valve *82* is seated, preventing flow of main reservoir air from pipe *4*.

1148-Q.—Explain how the train control system is charged. A.—Main reservoir charging air from chamber *A* below service application piston *112* of the brake valve, flows through choke *K* of the piston to chamber *B*, passage *10*, pipe 10, through the cut-out cock with seal, to pipe connection *4* and enters the timing valve, flowing to the top of upper valve *82*, which is seated as long as piston *90* is in its upper position.

1149-Q.—What brings about de-energization of the timing valve magnet? A.—It is de-energized from a train control signal.

1150-Q.—What is the result when the magnet is de-energized? A.—A train control application is initiated.

1151-Q.—What is the first resulting movement? A.—Spring *246* moves supply valve *243* upward to its seat, cutting off reducing valve air.

1152-Q.—What additional operation results? A.—The upper exhaust valve *240* is unseated.

1153-Q.—With the exhaust valve unseated, what then follows? A.—Air below piston *90* is permitted to flow through choke *X*, past unseated exhaust valve to the timing valve whistle and then to atmosphere.

1154-Q.—When the whistle blows, what does it indicate? A.—It is an indication that a train control application has been initiated.

1155-Q.—As the flow of air continues, what happens? A.—The air in the chamber acting on piston *90* is reduced and spring *92* moves the piston to its lower position.

1156-Q.—Does this happen immediately? A.—A time interval of approximately six seconds (due to choke *X* at ball check valve *27)* is required before the air in the chamber acting on piston *90* is reduced sufficiently to permit the spring to move the piston downward.

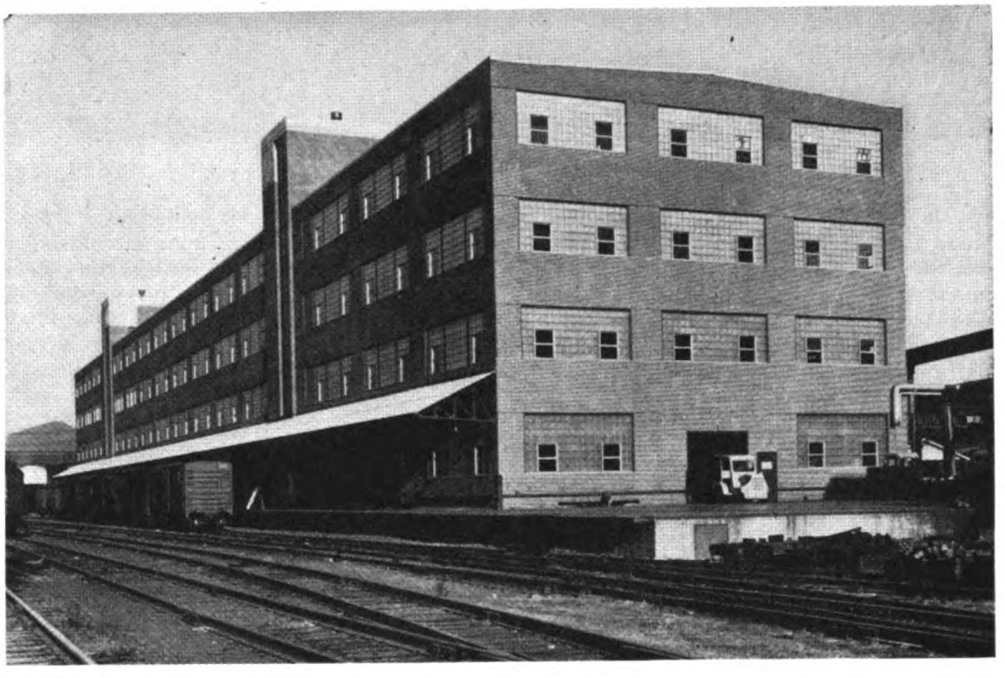
1157-Q.—What results from the downward movement of piston 90? A.—When the piston is moved to its lower position, spring *88* moves upper valve *82* and lower valve *83* downward.

1158-Q.—What flow of air then results? A.—When lower valve *83* is seated, the stop reservoir is closed off from exhaust and upper valve *82* is unseated, permitting air from chamber *B* on top of brake valve application piston *112* to be vented.

1159-Q.—Explain how the air from chamber B is vented. A.—Through passage *10*, pipe *10*, through the cut-out cock with seal, passage *4* in the timing valve, past the unseated upper valve *82* into passage *5*.

1160-Q.—What determines further flow of air at this juncture? A.—It depends on whether or not a suppression valve is used.

Battery Trucks in Storehouse Service



The Norfolk and Western's new storehouse at Roanoke, Va.

Practically all the material handled in the new Norfolk and Western storehouse is moved on pallets or in skid boxes by electric trucks

STORAGE battery electric trucks are used to handle nearly all of the material used at the Norfolk and Western's new storehouse at Roanoke, Va. The storehouse is a four-story structure, 70 ft. wide and 480 ft. long, and includes 130,000 sq. ft. of floor space—nearly three acres.

For movement of material in the building, to and from freight cars, and to platforms for delivery to the shops, there are seven fork-lift trucks and four lift-platform trucks. Two of the fork-lift trucks are equipped with 30-cell, type D7, 525 amp.-hr. Edison storage batteries. The five smaller fork-lift trucks and the four lift-platform trucks each use 10-cell, type C8, 450 amp.-hr. Edison batteries. With the principal exception of heavy items such as reels of wire rope, main and side rods, piston rods, etc., which are handled by an overhead crane spanning a part of the first floor of the storehouse, material is carried into and out of storage by the electric battery trucks.

On one side of the building, a loading and unloading platform acccommodates 12 box cars, while a recess on the other side provides space for six highway trucks and, when roller doors are lowered at both floor and ground level, serves also as a garage for company-owned trucks. No gasoline-propelled equipment is otherwise stored in this building. Material is moved between the storehouse and the shops by both highway trucks and tractor-trailer trains which make hourly trips.

Pallets and Skid Boxes

In general, material received or shipped by rail is carried on pallets by fork-lift trucks while material going to or from the various departments of Roanoke Shops is handled mainly in skid boxes by either fork- or platform-lift trucks, since skid boxes are used in the industrial-truck handling system in all departments of the shops. In both cases, virtually all material is carried into and out of stock in unit pallet or skid loads.

Material received by rail is piled on pallets in the cars and, when the quantity warrants, is tiered in storage on



The charging station on the first floor of the storehouse

pallets. Examples of material handled in this manner include soap, stoves, brooms, journal boxes, paper towels, bearings, jacks, shovels, nuts, bolts, nails, welding wire and bagged asbestos cement. The pallets employed are 48 by 48 in.

Material received in small lots is combined with one or more other small lots into mixed pallet loads which are carried to the receiving clerk for recording, checking, etc. The material is then reclassified as necessary and made up into other mixed pallet loads for delivery to the various sectional storekeepers. Material for outlying points is shipped on specified days and is carried from storage to outgoing cars by the reverse of the same procedure. In this way, virtually all material, regardless of the quantity, is handled both in and out by power trucking. Hand trucking has been virtually eliminated except for small, light items of material required for rush orders.

Similarly, material to and from the various departments of Roanoke Shops is handled in and out of storage in unit loads, with small lots being combined into mixed loads except that, as already mentioned, skid boxes are used instead of pallets. Handled in skid boxes are such things as valves, angle cocks, cut-out cocks, globe valves, brake beams, equalizers, etc.

The storehouse is served by four elevators, including two large freight elevators with automatic controls that can accommodate a truck with skid or pallet load. Depending upon circumstances, therefore, the trucks either may ride the elevators with their loads or may place them aboard for pickup by other trucks on the destination floors.

Charge Indicator Table for use with Type D7 Batteries (Normal rate 105 amp.)

Test fork Reading	Control of Charge: Ampere-hour Meter setting	Control of Charge: Time at 105 amp. Hours : min.
1.27	50	0:40
1.24	105	1:20
1.22	160	2:00
1.20	210	2:30
1.19	260	3:10
1.17	315	3:50
1.16	365	4:30
1.14	420	5:00
1.12	470	5:40
1.09	525	6:20
Below 1.09	590	7:00

If the test fork reading is between any two of the values indicated in this chart, the lower one is used.
The battery is allowed to stand at least one-half hour after discharge to permit the cells to stabilize. The prong of the fork is pushed over the contact pieces and the meter read after 10 seconds.

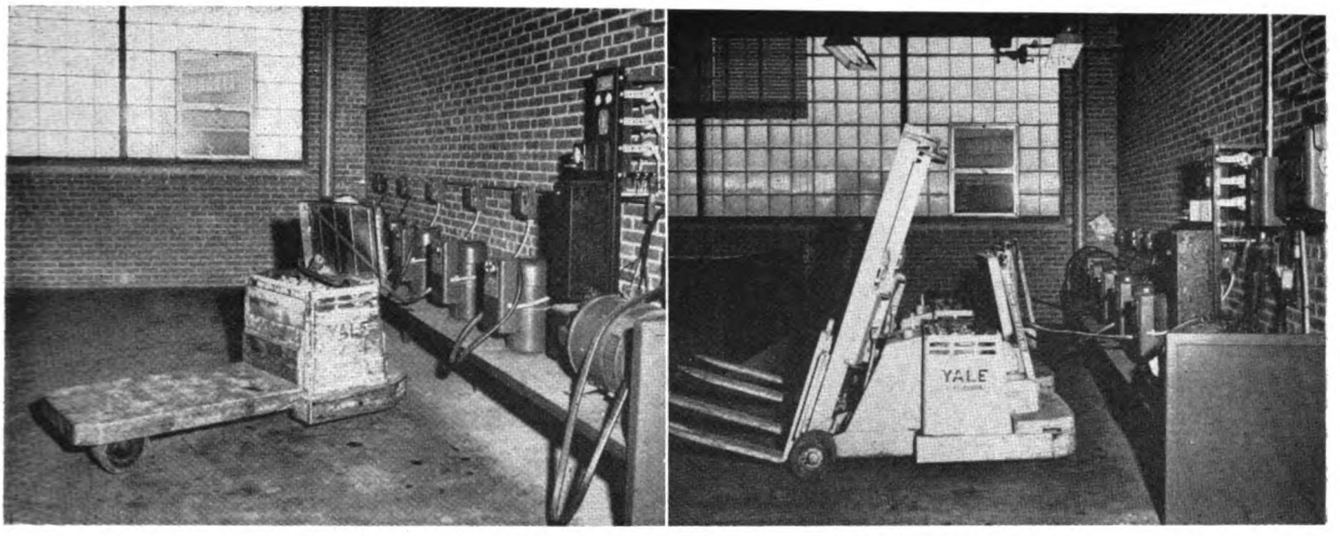
Battery Charging

A battery charging station is located on the first floor adjacent to the truck recess. It provides six charging circuits for 10-cell batteries as used in the "walkie" trucks and one charging circuit for 30-cell batteries as used in the larger fork trucks which handle the heavier loads. All circuits are provided with controls for fully automatic charging.



One of the larger fork-lift trucks powered by a 30-cell battery

The four vertical m.g. chargers are type BE-10-1 machines made by the Electric Products Company, each designed to charge one 10-cell, 338/450 amp-hr. Edison bat-



Left: A lift-platform truck without load at the charging station. Right: Two of the "walkie" fork-lift trucks without load and with batteries on charge

tery in seven hours. The maximum charging rate is 110 amp. The two horizontal sets at the left end of the row shown in one of the illustrations are Model 670-10-1 machines made by the Motor Generator Corporation, Troy, Ohio, and designed to charge a 10-cell, 450 amp.-hr. Edison battery in seven hours. The current rating is 126 to 70 amp. The 30-cell charger at the right, made by the Electric Products Company, is rated 60 volts and 147/62 amp.

The amount of charge to be applied to the 30-cell trucks is controlled by an amp.-hr. meter. The amount of charge for the 10-cell batteries is determined by checking their state of charge with an Edison test fork. The charge test fork affords a means of determining the state of charge quickly and with reasonable accuracy, and thus permits giving each battery the correct amount of current input to restore it to a fully charged condition.

In operation, the instrument measures the voltage delivered by a pilot cell across a resistor having a temperature-resistance coefficient so low, its resistance remains virtually constant throughout the normal temperature range. This, together with the fact that the voltage of the Edison cell at a given current rate bears a known relationship to its state of charge, forms the basis of the operation of the instrument. From the voltage reading of the pilot cell, the state of charge of the battery and the current input required to restore the battery to a charged condition, are then determined by reference to the charge indicator table furnished with the instrument. Charging time and amp.-hr. setting for D-7 batteries are given in the table.

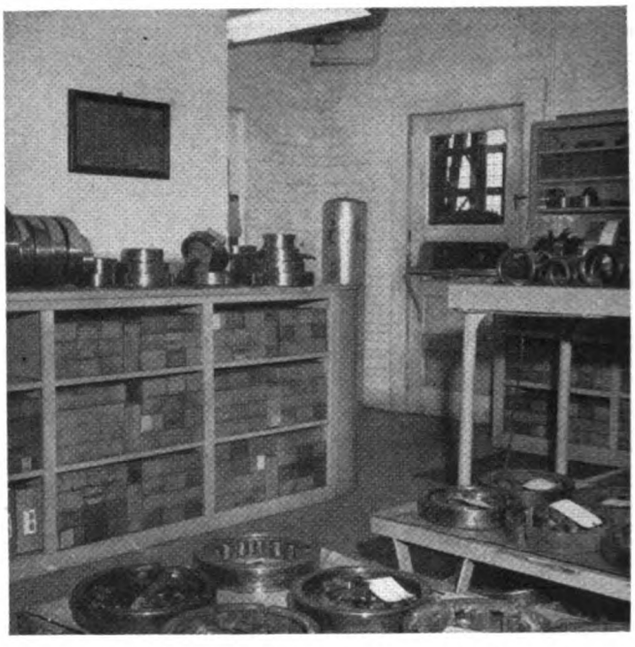
Each set is equipped with a time clock, or amp.-hr. meter. This is set in accordance with the voltage reading. The time clock is set to the proper value, the battery connected, and the machine started manually. The time clock shuts it down automatically when the charge is complete.



Interior view of the storehouse showing one of the lift-platform trucks carrying a loaded skid-box



Storehouse in one end of former flue shop provided space for material used in repair shop operations



Bearing assembly room with glass fronted cabinets for storage of new and reworked assemblies

Motor Shop Records As Kept by the Southern

Facilities developed by the Southern for maintaining diesel electrical equipment were described in the May issue of *Railway Mechanical and Electrical Engineer*. Operation of the shop was covered in the June issue. Some of the forms used for inspection and procedures during the repair and overhaul of motors and generators are shown on the following page. In addition, a record card, Form 1170, acts as the master record for each motor, listed under the serial number of the motor. Originally each diesel repair shop maintained a card of this sort in a permanent file, but with the large number of motors in service and the fact that they were frequently transferred from one territory to another, this arrangement did not prove satisfactory. The present procedure is to hold Form 1170 for a motor of a given serial number in a file in the diesel shop office of the territory where the motor is in service. When the motor is removed from service, the data on mileage is entered on the card, which is then mailed to the location where the motor is shipped. For example, if a motor is removed at Chattanooga for mileage overhaul, the clerk in the shop office fills in total mileage made by the motor between the time it was installed on the locomotive and the time it was removed. When the motor is shipped to Atlanta for overhaul, the card is mailed to the foreman of the traction motor shop, together with a notation as to whether the motor is removed for mileage overhaul or defect.

When the motor is shipped from Atlanta to Chatta-

20M 5-47 FORM 1170

SOUTHERN RAILWAY SYSTEM

SERIAL NO._____

Traction Motor Record

MAKE_____ TYPE_____ PINION_____ DATE REC'D_____ TERMINAL_____

LOCOMOTIVE NUMBER	UNIT	PED.	INSTALLED		REMOVED		MOTOR MILEAGE	MOTOR MI. SINCE LUBRICATION	REASON REMOVED
			DATE	LOCOMOTIVE MILEAGE	DATE	LOCOMOTIVE MILEAGE			

Master record card for traction motors filed under the motor serial number. The master record card is maintained in a file in the territory where the motor is in service

nooga or any other point on the system, the card is mailed to the corresponding master mechanic. Printed memorandum forms are used for transmittal.

Miscellaneous Repair and Overhaul

The procedure and operations discussed for traction motor repairs also apply for main generator mileage overhaul or rewinds. The machinery and equipment installed has sufficient capacity for the larger generator frame and armatures, and essentially the same procedure is followed in the overhaul and rewinding operations.

Provisions have also been made for repair work on auxiliary generators, alternators, small accessory motors and control equipment, most of which work is concentrated at Atlanta for the entire system. Traction motor blower, cooling fan, pump and other auxiliary motor armatures are rewound when required in a separate section of the shop.

Space was made available in one end of what was formerly a flue shop, and a storehouse has been provided to serve the repair shop operation. All material, parts and supplies necessary for this work are stocked in this location, eliminating the necessity of sending an employee to the main storehouse for necessary material. The saving in time of mechanics is sufficient to justify maintenance of a storehouse attendant during shop working hours.

Experience with the design, construction and operation of this repair shop has demonstrated the importance of planning the initial layout so that adequate space will be available for future expansion.

Inspection report filled out by foreman upon arrival of a motor in the shop. If reported defective, the form is stamped "Failure—Inspect for cause"

Motor Inspection on Arrival

Serial number _____ Type _____

Mileage run _____ Did motor fail in service _____

Condition of pinion _____ Tooth _____

Condition of P.E. grease pipe _____

Condition of C.E. grease pipe _____

Condition of V-ring string band _____

Condition back of commutator riser _____

Condition of commutator _____

Any indication of oil in motor _____

Brush grade _____ Condition as follows:

Axle	Top	Susp.	Bottom
1._____	1._____	1._____	1._____
2._____	2._____	2._____	2._____
3._____	3._____	3._____	3._____

Condition of commutator _____

Condition of bearings _____

Remarks _____

Signature _____ Foreman

Date _____

CAPTION: Inspection report filled out by foreman upon arrival of a motor in the shop. If reported defective, the form is stamped "Failure-Inspect for cause"

Armature Report

Serial No. _____ Type _____ Manufacturer _____

Commutator Serial No. _____ Date of Commutator _____

Rec'd in shop on Job. No. _____ Motor No. _____ Date _____

Out of shop on Job. No. _____ Motor No. _____ Date _____

Mileage this application _____ Accumulated mileage _____

Note below any unusual conditions such as possible overload or overheating, solder thrown out, coil leads loose in riser, commutator bars burnt, shaft B.O. _____

Is armature new, rewound at Atlanta motor shop or service _____

Megger reading of armature at disassembly (before cleaning) _____

Megger reading of wire bands at disassembly (before cleaning) _____

Does armature shaft Magna-flux O.K. P.E. _____ C.E. _____

Shaft renewed _____ Stamped with Ser. No. _____ Spec. Stamping _____

Condition of wire bands C.E. _____ P.E. _____ Band clips C.E. _____ P.E. _____

Apply new wire bands P.E. lower at _____ lb. tension -- Size wire used _____

Apply new wire bands P.E. upper at _____ lb. tension -- Size wire used _____

Apply new wire bands C.E. lower at _____ lb. tension -- Size wire used _____

Apply new wire bands C.E. upper at _____ lb. tension -- Size wire used _____

Are bands properly soldered and clips in place C.E. _____ P.E. _____

Aas wire band insulation renewed _____ Condition of P.E. Coil supports _____

Are slot wedges tight _____ General condition of core _____

Condition of string band _____ Aas string Band renewed _____

Clean armature and preheat _____ Hours at _____ deg. C. Chart no. _____

Impregnate armature and take _____ Hours at _____ deg. C. Chart no. _____

Clean riser, V-ring and string band and paint red _____

Clean P.E. coil support and spray armature with air drying varnish _____

Tighten commutator bolts at _____ lb. (average) Were bolts renewed _____

Are commutator bolts locked or welded in place _____ Which method _____

Dial indicate commutator (before machining) taper _____ Out of round _____

Machine commutator (hone, grind or turn) _____ Bevel end of bars _____

Diameter of commutator (after machining) _____ Dial indicate shaft _____

Note below any special machine work done on armature or shaft _____

Dial indicate commutator (after machining) taper _____ Out of round _____

Undercut mica _____ X _____ And remove burrs on commutator bars _____

Initial unbalance C.E. _____ Oz. at _____ deg. P.E. _____ Oz. at _____ deg.

Correction made C.E. _____ Oz. at _____ deg. P.E. _____ Oz. at _____ deg.

Final unbalance C.E. _____ Oz. at _____ deg. P.E. _____ Oz. at _____ deg.

Bar to bar test in microns--Minimum _____ Maximum _____ Average _____

Megger reading before high potential test-armature _____ bands _____

Apply high potential test of _____ Volts A.C. for _____ Seconds to armature

Apply high potential test of _____ Volts A.C. for _____ Seconds to wire bands

Make armature final inspection, Apply identification tag _____

Note 1 _____

Note 2 _____

Note 3 _____

Note 4 _____

Report No. _____ Signed _____ Inspector

Serial No. _____ Date _____

CAPTION: Armature inspection and data report for armatures undergoing repairs. Upon completion, the report is filed to form a permanent record

Above: Armature inspection and data report for armatures undergoing repairs. Upon completion, the report is filed to form a permanent record. Below: Field coil and frame report for a record of condition and work done on a frame being overhauled

Field Coil and Frame Report

Motor serial No. _____ Job No. _____

Type or model No. _____ Manufacturer _____

Megger reading of field frame before cleaning _____

Is there any indication of thrown solder in frame _____

Examine frame for loose or chaffed coils _____

Clean frame and preheat _____ Hours at _____ Deg. C. Chart No. _____

Tighten all pole bolts while frame is hot (before dipping) _____

Are all brush holder support brackets tight (test with hammer) _____

Does brush holder clamp bolts turn freely to extent of threads _____

Condition of internal cables and connections _____

Paint frame and coils with two coats of air-drying varnish _____

Remove and clean external cable blocks _____ Renewed _____

Condition of external cables _____ Renewed _____

Condition of rubber frame grommets _____ Renewed _____

Condition of cable hose _____ Renewed _____ Terminals _____ Renewed _____

Are cap screws to pole piece on axle side welded _____

Reseal rubber frame grommets and top pole bolts _____

Clean connections and install brush holders in frame _____

Megger reading before applying high potential test _____

Apply high potential test of _____ Volts A.C. for _____ seconds

The Following High Potential Tests Apply to Main Generators Only

Battery field _____ Volts A.C. for ___ sec. Shunt Field _____ Volts A.C. for ___ sec.

Start field _____ Volts A.C. for ___ Sec. Diff. & Comm. field _____ Volts A.C. for ___ sec.

Apply high potential of ___ Volts A.C. for ____ Sec. Pos. to Neg. brush holders

Set all brush holders at _____ In. above commutator and tighten _____

Install new brushes, sand in and clean carbon dust out of C.E. _____

Does polarity check O.K. _____

Chalk commutator and observe operation -- Results _____

Blow out C.E. with air and recheck all brush holders _____

Dial indicate commutator (string band to riser) (1) _____ (2) _____ (3) _____

Apply commutator covers (with new felts and factory cap screws) _____

Clean cable terminals, cover with paper and tie up leads _____

Note 1 _____

Note 2 _____

Note 3 _____

Note 4 _____

Note 5 _____

Signed _____ Date _____

Report Below Any Special Work Performed

Signed _____ Date _____

Report No. _____

CAPTION: Field coil and frame report for a record of condition and work done on a frame being overhauled

DIESEL-ELECTRICS—How to Keep 'Em Rolling

1 Fundamentals Helpful in Maintaining Electrical Equipment*

When a few principles are really understood, the work of maintaining electrical equipment on diesel locomotives is made relatively easy

THE diesel-electric locomotive is a sturdy, economical, willing workhorse. Its precision-built engine is one of the most efficient means we have of turning the energy of fuel into mechanical power. Its specially designed electric transmission has unequaled flexibility and automatic adjustment to all conditions of speed and load.

Electric and mechanical equipment, in about 50-50 proportions, makes up the locomotive. The diesel engine develops mechanical power which is used to drive the main (traction) generator. Electric power from this generator operates the driving (traction) motors which are geared to the locomotive axles.

No locomotive earns money when it is tied up at terminals or in the backshop. It is to everyone's interest to keep motive power on the road as much as possible. Intelligent maintenance will go a long way toward reaching this goal. The problem of the maintenance man —"how to keep it running"—can best be solved by learning "what keeps it from running." A large percentage of electrical failures on locomotives are caused by one or more of the following:

1. Loose electric connections
2. Lack of cleanliness of equipment
3. "Monkeyitis"
4. Lack of knowledge of electrical equipment

Good maintenance will prevent failures from the first two causes. Education is the answer to the other two. A man is naturally curious about the equipment with which he works. If he cannot get proper information about it, he will try to find out for himself how it works. Then he is likely to make an "adjustment" to the equipment which prevents it from working properly. This is often called "monkeyitis." Obviously if a man knows what a piece of equipment is, how it works, and what it is used for, he will not be curious about it and will not be tempted to monkey with it.

Failures arising from "lack of knowledge" can also be cured by education. The railroad man who understands the few simple principles of electricity that apply to the diesel-electric locomotive will be able to do a better and more intelligent maintenance job.

The A, B, C of Electricity

Nobody knows what electricity is;—but we do know how it behaves, and how to use it in many different ways. A good way to understand the behavior of electricity is to compare it with the action of water. Let us do this for a diesel-electric locomotive, as shown in Fig. 1. The pump

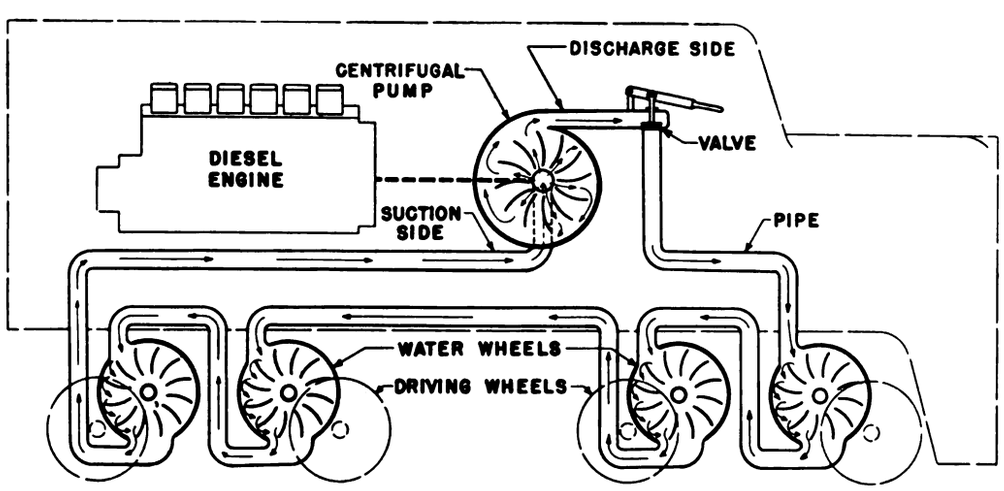


Fig. 1—Mechanical analogy of a diesel-electric locomotive drive. Here, the engine drives a pump (the generator) which forces water through pipes (the cables) to water wheels (the motors) which drive the axles

* This is the first of a series of articles on maintenance of diesel-electrical equipment. The first article is written by Harry R. Hill, Technical Service Division, Locomotive and Car Equipment Divisions, General Electric Company, Erie, Pa.

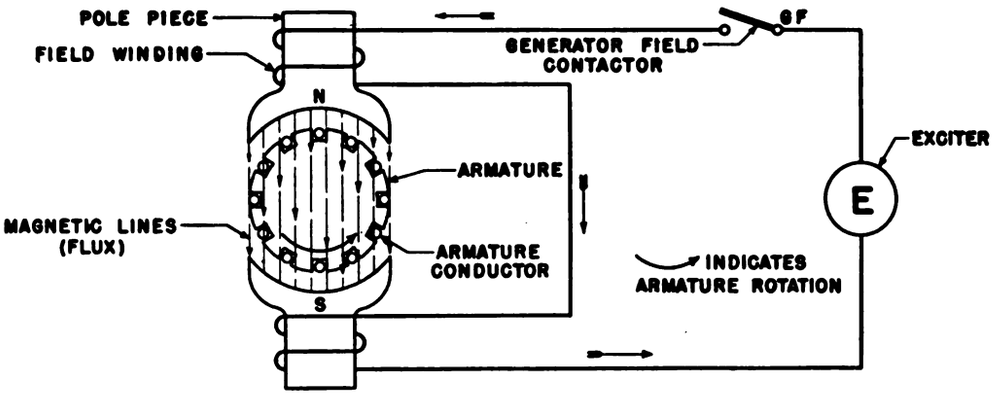


Fig. 2 — Schematic diagram of a generator showing how the armature conductors cut through the magnetic lines of force between the pole pieces

corresponds to the traction generator, the water wheels to the traction motors, and the pipes to the connecting cables.

At first, let us assume that the diesel engine is idling with the valve closed (line switch open). Then the pump (generator) is producing pressure (voltage), but there is no flow of water (current), so the water wheels (motors) do not revolve.

Now suppose the throttle is moved to the first notch. This opens the valve (closes the power contactors), and water (current) begins to flow. This flow causes pressure against the blades of the water wheels. If the locomotive has a heavy train, the pressure (voltage) will not be enough to move the wheels.

The engineman now notches up his throttle. The diesel engine speeds up, and the pump pressure (voltage) increases. This causes more water (current) to flow through the water wheels (motors). He continues notching up the throttle until there is enough gallons per minute (amperes) flowing to start the wheels turning. As they revolve, the locomotive and train begin to move. As the engineman continues to advance his throttle, the diesel engine speeds up, pressure and flow increase, and the locomotive accelerates.

Magnetism

The operation of both generators and motors depends upon magnetism. Early investigators found that when a wire was moved near a magnet, an electric voltage was generated in the wire. This principle applied to a generator or motor is shown in Fig. 2. The pole pieces are magnetized by the flow of current through the coil of wire wrapped around each one.

If a compass were placed in the space between the poles, the needle would turn until it pointed toward the north pole (N). This shows the presence of a magnetic field between the poles. When we place a set of conductors wound on an iron cylinder (armature) in this magnetic field, we have a simple electric machine.

Generator Action

Let us suppose that the machine in Fig. 2 represents the main generator on the locomotive. The coils on the pole

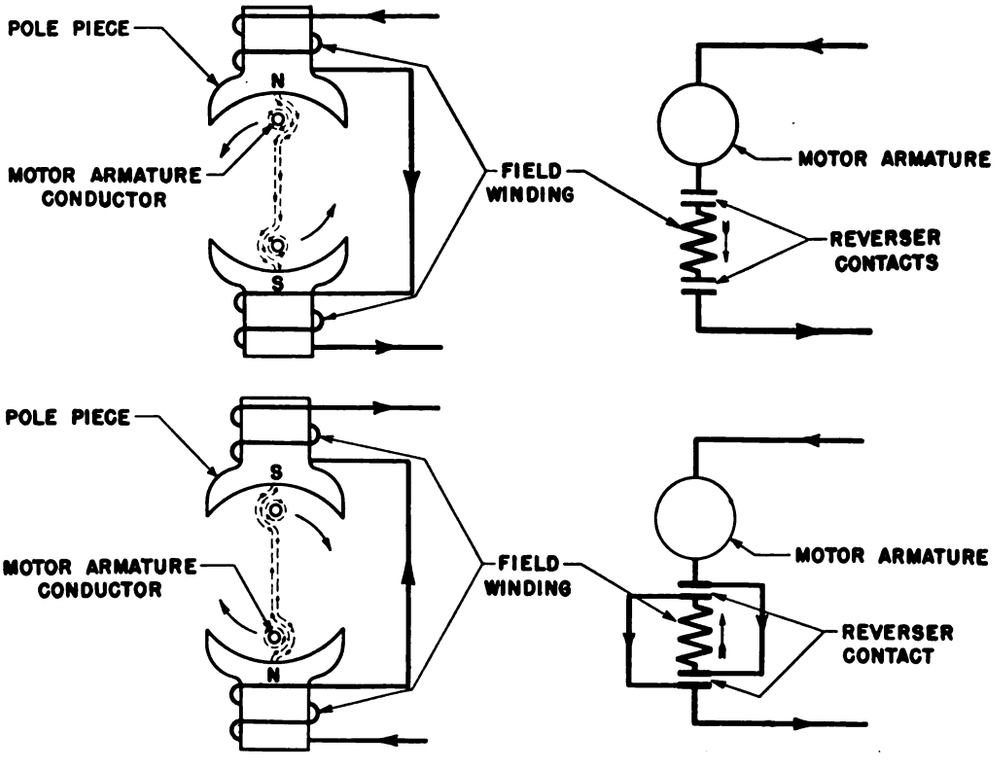


Fig. 3—When current carrying wires are in a magnetic field, a force is generated which tends to move them out of the field. Directions of movement depends on direction of current flow

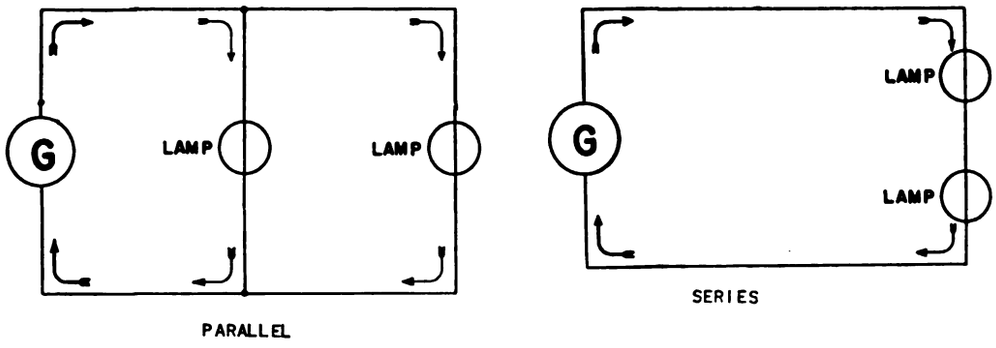


Fig. 4—Parallel and series circuits. In the former, half the current flows through each lamp. In the latter, all the current flows through both lamps

pieces would then be called the "generator field winding." The current which passes through them would be the "field current." Passing this current through the field winding would be called "exciting the field." Therefore, the small generator, *E*, which supplies this current is called the "exciter." The main generator armature is coupled to the diesel engine crankshaft. As the engine runs, the armature conductors move in the magnetic field and generate voltage. The faster the conductors move, the greater the voltage they will generate. Also, the stronger the field, the greater the voltage. The field strength can be increased by increasing the field current (excitation).

The rules for generating voltage are: Rotate the armature and excite the field. The rules for changing the voltage are: Change the armature speed, or the field current, or both at the same time.

Voltage generated in the armature conductors is useful only if it can be made to send current through the traction motors. To do this, we must connect the rotating armature conductors to the motor circuit. This is done by the commutator and brushes.

The front end of each conductor is connected to a copper bar in the commutator. The brushes are held in a fixed position and slide on the commutator as it revolves. When a pair of bars makes contact with the brushes, the voltage in the armature conductors connected to them will cause current to flow, if the line switch, (Fig. 1), to the motor is closed.

Motor Action

Now let us suppose that the machine in Fig. 2 represents a traction motor. The construction is about the same except that the armature and field structure of the motor are smaller than those of the generator in a locomotive. The action of the two machines differs. In the generator, the diesel engine turned the armature, while in the motor, the armature is caused to turn by passing a current through it. This depends upon another fact discovered by early investigators. When a current passes through a wire, it sets up a magnetic field around the wire. This happens when current is sent through the armature conductors of the motor. The magnetic field caused by this current reacts with the magnetic field set up by the pole windings and causes the armature to rotate.

The rule for motor rotation is: when a conductor carrying a current is in a magnetic field, it tends to move out of that field. The direction of the motion depends upon the direction of the magnetic fields.

The reason for this can be seen from Fig. 3. Imagine the magnetic field set up by the poles of the motor to be like a lot of rubber bands stretched between the pole pieces. When a current flows through the armature conductors, the magnetic action pushes some of these "rubber bands" to one side, as shown in the upper half of Fig. 3. This sets up a force which turns the armature in the direction of the large arrows. If the direction of the field is reversed, the magnetic action of the armature will push the "rubber bands" to the opposite side and the armature will turn in the reverse direction, as shown in the lower half of Fig. 3. In the case of locomotive traction motors, this reversal is obtained by interchanging the connections of the motor field, as shown to the right in Fig. 3.

Motors of this type are called "series-wound" or simply "series" motors because the armature and field windings are so connected that all of the current flows first through one and then through the other. They are universally used on diesel-electric locomotives because the heavy current passing through both the armature and field windings develops powerful magnetic fields. These fields push apart with such force that the motor develops a very strong "torque," or turning effort at starting.

Types of Electric Circuits

The two types of circuits—the series circuit and the parallel circuit—are illustrated in Fig. 4.

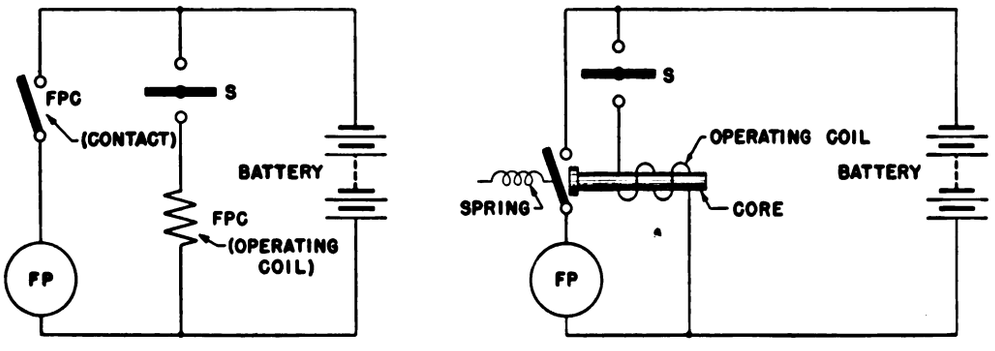


Fig. 5—At the left is a schematic diagram of the circuits used to control a fuel pump motor. At the right is a diagrammatic sketch showing the same thing

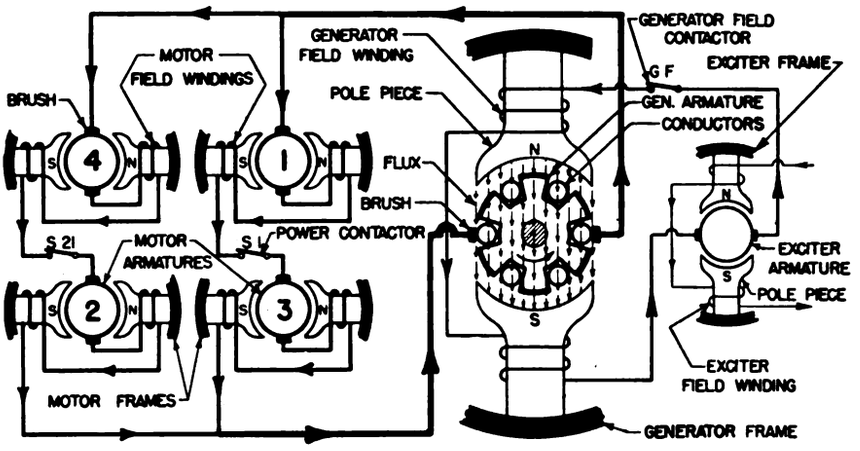
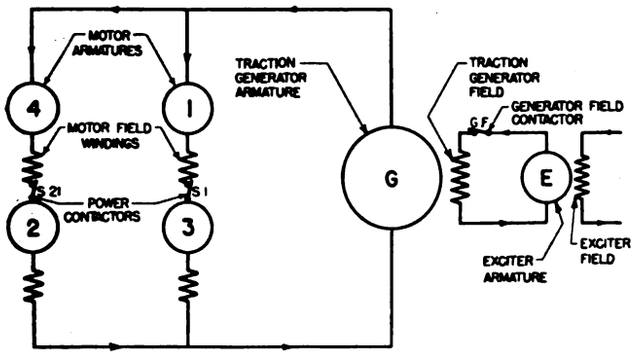


Fig. 6 (right)—Main power circuits of a diesel-electric locomotive

Fig. 7 (below)—The way the power circuits of Fig. 6 are shown in a wiring diagram



The series circuit is shown on the right. In it all of the current delivered by the generator flows through each piece of apparatus in the circuit. However, only part of the voltage is used by each piece of apparatus. If the voltages used by the separate pieces are added together, the sum will equal the voltage of the generator.

The parallel circuit is illustrated on the left. In it each piece of apparatus receives only part of the total current, but each receives full voltage from the generator. If both pieces have the same resistance, the current will divide equally between them, each receiving half of the total current.

These two types of circuits may be combined into what is known as the series-parallel circuit. This is used in the power circuits of many diesel-electric locomotives as will be explained shortly.

Contactors and Relays

As we have already seen, voltage can cause a current to flow only if the electric circuit is complete. A complete circuit, containing a power contactor *GF*, is shown in Fig. 2.

A power contactor is nothing more than a remotely controlled switch. The right half of Fig. 5 illustrates diagrammatically a simple control circuit which operates a contactor to start a fuel pump motor. When the switch S is closed, battery current flows through the operating coil of the contactor. This magnetizes the core and pulls the contact to the closed position to permit current to reach the fuel pump motor. Such a contactor is called a magnetic contactor. It is used in circuits where the current is small. The left half of Fig. 5 shows how this same circuit would appear in a schematic diagram.

When a contactor is used in a traction motor circuit it will be called upon to pass very heavy currents and it is important that the contact tips be pressed together very tightly. For this reason, contactors operated by compressed air are used. They are pneumatic contactors.

The pneumatic contactor makes used of a magnet valve. This has an operating coil similar to the contactor in Fig. 5, except that the core is movable. When the operating circuit is closed and current flows through the coil, it moves the core by magnetic attraction. This movement opens the air valve and admits air at 70 lb. pressure to the operating cylinder of the contactor. The piston of the air cylinder pushes the contacts together. The 70-lb. air pressure insures that the contacts will be held together very tightly.

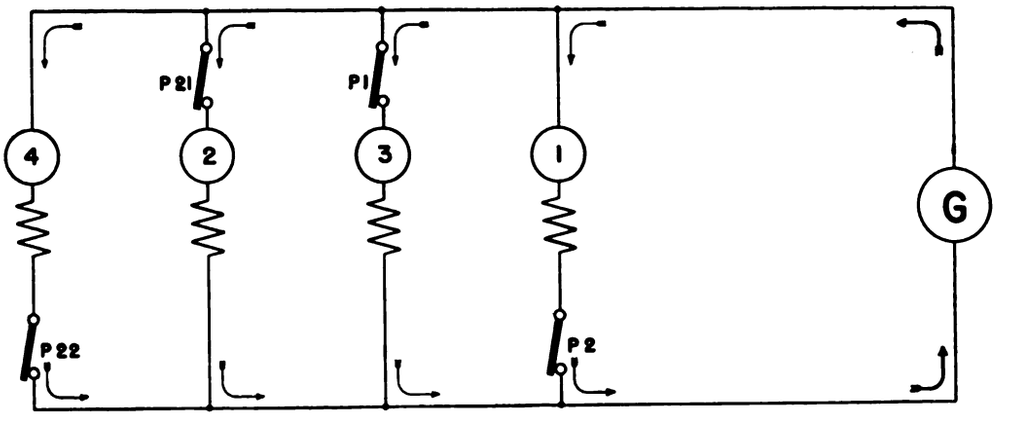


Fig. 8—Diagram showing four motors connected across the generator in parallel as used for operation at the higher speeds

When circuits carrying very low currents must be controlled remotely, a relay is used. This operates in the same way as a magnetic contactor, but its contacts are much lighter in construction. The reason for this is that the relay contacts rarely have to pass more than a few amperes.

Locomotive Circuits

Circuits on a locomotive are of two types,—power circuits and control circuits. The power circuit includes the main generator and traction motors, and the cables and contactors which connect them. When locomotives are equipped with dynamic braking, the resistors are included in the power circuit. Control circuits include lights, excitation system, battery charging circuit, governor control circuits, relay and contactor coil currents, and small motor circuits.

Power circuits may operate over a range from 0 to 900 volts, and may carry up to several thousand amperes of current at times. Control circuits operate at 75 volts and usually carry a few amperes or less. In fact, the total current in all the control circuits on a locomotive rarely exceeds 200 amp.

Let us see now how the electric apparatus on a diesel-electric locomotive is connected. A diagrammatic representation is given in Fig. 6.

The diesel engine is rotating the traction generator and exciter armatures; thus, generating voltage at the exciter commutator. In order to move the locomotive, the engineman merely pulls the throttle from *Idle* position to the first notch. This automatically causes the *S1*, *S21* and *GF* power switches (contactors) to close. With *GF* closed, current from the exciter flows through the main generator field winding to produce a magnetic field. This closing of *S1* and *S21* allows current to flow through traction motors *1* and *3*, and *4* and *2* respectively as indicated by the arrows, causing the motors to turn.

To reverse the direction of motion of the locomotive, the engineman pulls his reverse handle to the *Reverse* position. Then when the throttle is moved from *Idle* to notch *1*, the reversing switch (not shown in Fig. 6) is thrown to the reverse position. The contacts on this switch route the current through the motor fields in the opposite direction, causing the traction motors to change their direction of rotation.

Fig. 7 shows how this circuit would be drawn on a schematic wiring diagram. We see it is a series-parallel circuit in which half of the generator current reaches each motor, and each motor uses half of the generator voltage.

The series-parallel motor connection is used to start the locomotive and train and accelerate to medium speed. The connections are then changed to a parallel circuit as shown in Fig. 8. Here each motor receives one-fourth of the generator current, but uses all of the generator voltage. This motor connection is used to accelerate to high levels.

Doing a Good Job

This brief review of elementary electrical principles will not make an electrical engineer out of a maintenance man. They are only those everyone needs to know to understand the "why" of a diesel-electric locomotive. Once the maintainer has them clearly in mind, he will be able to go about his work in a more intelligent manner. The "how" of his job will begin to make sense. He will work more effectively and efficiently. As a result, locomotives will be available for service a greater percentage of the time, road failures will be reduced, and everybody will benefit.

CONSULTING DEPARTMENT

Where Do Good Foremen Come From?

In your March issue you asked how morale can be made an active factor in the diesel shop. To my way of thinking there is nothing else quite so important as the foreman in building up good morale. Now, what I want to know, is how do we find good men for foremen and how do we train them for the job?

There Is No Perfect Foreman!

How can good foremen be selected when they come in such a variety of sizes and ages? What are the latent abilities, if any, and how can they be developed? After we have found a man possessing those four fundamental qualities of honesty, sincerity, loyalty, and fairness, what other things should we look for and is there an order of importance for these items? This problem is almost universal and it is quite complex. If there was a simple and easy answer, it would have been found long ago. In twenty or more years of trying to pick good foremen, I have not found the answer, but I have collected a few suggestions that might help simplify the problem.

The factors required in a foreman can be most intelligently viewed after analyzing what a foreman is expected to do. These requirements vary so widely between railroad shops that each location should be studied independently. For example, one maintenance group listed twenty items while another listed forty-four items a foreman was expected to do as a part of his daily routine. This last list was divided into two groups,—those items requiring ability to deal with people, and those requiring ability to deal with material things:

Jobs Requiring Ability To Deal With Personnel

Check to see if men are on the job.
See that men start work on time.
See that men work the required number of hours.
See that men's time is not wasted.
Check up on absentees and get reasons.
Assign men to jobs according to ability.
See that orders are understood by men.
Break in men on new kinds of work.
Properly instruct men in how to do work.
See that men do jobs correctly.
See that material is not wasted.
Instruct men in safety.
Represent company to the men.
Represent men to the company.
See that company's rules are enforced.
Promote cooperation among men.

Encourage loyalty.
Stimulate and inspire ambition and progress in working personnel.
Encourage men to do better work.
Commend men for efficient work.
Constructively reprimand men when necessary.
Keep accurate and impartial efficiency record of men.
Cooperate with foremen of other sections and departments.
Be fair and impartial.
Set a good example.

Jobs Requiring Ability To Handle Work and Materials

See foreman on previous shift in reference to jobs.
Find out what work has to be done during shift.
Line up jobs according to urgency.
Plan work systematically.
Estimate time required for jobs.
Plan work ahead for the men.
Have tools and machines ready.
See that material is on hand.
Report unsatisfactory material promptly.
See that rush jobs go out when finished.
Make a study of maintenance records.
Improve equipment performance by better maintenance.
Report unusual conditions promptly.
See that working conditions and equipment are safe.
See that working conditions are orderly and clean.
Suggest improvements in working conditions, equipment and facilities.
Report excess or insufficiency of labor in department or section.
Supply accurate information for all records.

In practice, a large majority of a foreman's time will be spent on those items dealing with people. If a proper job is done in this area, little will need to be done in other areas because groups working together as a team can do much more towards correcting material or equipment problems than an individual foreman can by working alone.

Few items will bring forth more answers or controversy than trying to arrange the requirements of foremen in any order of importance. A clue to the big problem of selecting good foremen may be found in the fact that few people agree on what a foreman should be. Perhaps one of the first steps then is a careful analysis of what you require or expect of your foreman. For example, my requirements for a railroad maintenance shop foreman, employing approximately twenty-five men, would be about as follows, and listed in this order: (1) Honesty; (2) sincerity; (3) fairness; (4) loyalty; (5) dependability; (6) leadership; (7) personality; (8) judgment; (9) initiative; (10) technical ability; (11) perseverance; and (12) ingenuity.

The list emphasizes the importance of abilities in dealing with people as compared with the importance of abilities to deal with machines and equipment. You are not going to always find all of these characteristics in your prospective foreman. Therefore, the second phase of your program is to develop or fill out the deficiencies. This means a foreman training program is an essential part of every maintenance operation.

Early in any foreman's selection or training program, management should carefully evaluate their policies with respect to their supervisory staff. It should be possible for them to set down clearly their philosophy of foremanship. In the past, foremen were often considered only as policemen or the "wielders of the club." This attitude is not in keeping with mproved management practices and, in my opinion, is one of the least necessary elements in good foremanship. I think proper foremanship virtually eliminates the need for policemen or disciplinary action. Whenever disciplinary action is required, it is a direct admission of failure on the part of some foremen to cope with his job. Of course, after acts of insubordination, direct violation of rules, and many others have been perpetrated, disciplinary action must be taken. These deeds occurred after the foreman's failure, and are only the superficial evidence of this previous inadequacy.

It may appear that the foreman's task is an impossible one because no man has been able to lead all mankind to righteousness. Being the perfect foreman is beyond our human grasp, but the desire to be that man is within reach of all. Honestly aspiring to that lofty ideal will do much to encourage foremen to carefully analyze their deficiencies after they have faced a situation requiring corrective measures. The foreman's influence is always present in any employee conduct or morale problem. This participation begins the day the employee starts to work, and ends only after his services have been concluded.

Effective foreman training can be as elaborate or simple as management wishes. In general, the programs must be adjusted to the needs of each railroad. Instruction programs must be laid out with an appreciation of the foreman's ability to absorb. In the main, foremen are practical men, more concerned with the arithmetic of getting specific jobs done than they are with the algebra or theoretical philosophy of supervision. Training programs to be effective should bear a close relationship to the specific job that the foreman has to do. Conference groups under the direction of an able leader are one of the best methods of teaching the elements required. It should be pointed out that a single conference, or group of conferences lasting a few months, will rarely do the job. A foreman's job is complex, and is continually changing. If foremen are to keep pace, they must continually grow and improve in stature and knowledge of their jobs. This means that the foreman training job will never be done.

Many textbooks on foremanship are available, and more are being written. There are numerous volumes on psychology and other related subjects for background or reference material. Therefore, material is not a serious problem. The success or failure of foreman training programs are more often determined by the attitude of the participants than by the subject matter available.

E. S. Lowe.

Diesel-Electric Locomotive Batteries

Questions and Answers

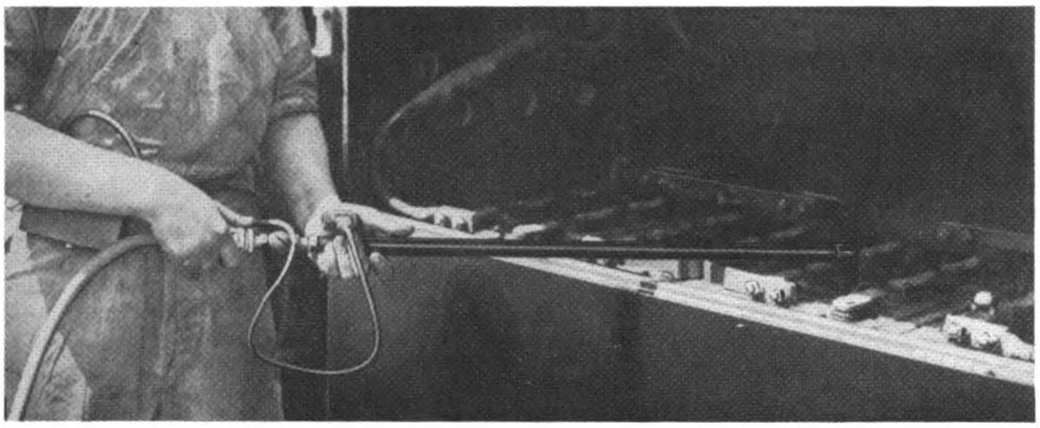
Q.—How can an operating check of voltage regulator performance be made without a voltmeter?

A.—When a locomotive is equipped with an ammeter, the Electric Storage Battery Company recommends the following method for making a rough check on voltage regulator performance:

Make certain that the battery is approximately fully charged and that the generator and voltage regulator are at operating temperature.

Observe the charging rate indicated by the ammeter with the engine running at medium speed.

Stop the engine and shut off the fuel pump.



Adding water to a locomotive starting battery with an automatic cell filler

Roll the engine over two or three times, by use of the battery starter.

Open the fuel pump and start the engine.

Observe the charging rate with the engine running at medium speed.

The charging rate should be higher than before, because the battery was partially discharged by the rolling over and starting of the engine.

After a few minutes of running, the battery should again be fully charged and the charging rate should have decreased to about the same rate observed at the beginning of the test.

If the charging rate does not taper off to approximately the same value, the voltage regulator may have too much frictional lag at the pivots or other points, and it should be adjusted mechanically, the proper setting being made with a voltmeter.

Q.—When and how should water be added to a storage battery?

A.—Only approved or distilled water should be added to the cells at sufficiently frequent intervals to keep the electrolyte level above the tops of the splash covers. When adding water, fill to $\frac{1}{8}$ in. below the bottom of the cover filling tubes, and no higher.

Careless addition of water above the high level point results in overflow of electrolyte through the vent plug openings provided for normal gas escape.

An overflow of electrolyte lowers the gravity, reduces battery capacity, rots wood trays and damages the battery compartment. It also causes corrosion and troublesome grounds in the electrical circuits. Eventually, it will necessitate removal of the battery for gravity adjustment and repairs to damaged parts.

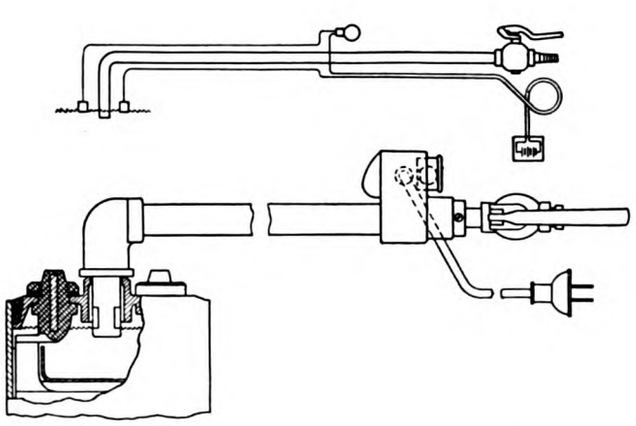


Diagram showing operating principle of Exide automatic cell filler

Proper use of an automatic cell filler, as shown, will eliminate overfilling. The principle and operation of the Excide type cell filler is illustrated in the figure which shows a wiring diagram and outline of the filler with nozzle inserted in the filling tube of a cell. When the electrolyte reaches the proper level, it closes an electric circuit, lighting a warning light. The operator then shuts off the supply of water manually.

The amount of water used is a good indication of whether the battery is receiving the correct amount of charge. As a general rule, a battery in good condition using more than approximately $\frac{1}{2}$ in. of water per month, is receiving too much charge. If it uses less than approximately $\frac{1}{4}$ in. per month, it is not receiving sufficient charge for a locomotive in daily service all cells should require the same amount of water. If one cell takes more water that the otherr examine it for leakage.

Always take hydrometer readings before adding water.

The time of adding water is important in cold weather. When it is cold, add water just before the locomotive goes into service, so that the charging current will mix the water with the electrolyte. If water is added, and the battery left standing in freezing temperatures, it will freeze. Since water expands when it freezes, it can damage the hard rubber battery container by cracking it.

Only approved or distilled water should be added to batteries. The former is water which has been analyzed periodically and found to be safe for storage battery use. The Electric Storage Battery Company performs this service free of charge when properly identified quart samples are sent to its Allegheny Avenue plant in Philadelphia and transportation charges are prepaid.

If approved water is drawn from a tap, it should be allowed to run a few moments before using. Water should not be transported or stored in any metallic vessel, except one made of lead. Glass, earthenware or rubber receptacles that have not been used for any other purpose are satisfactory.

Nothing but water should be added to a storage battery. Never add special powders, solutions or jellies. A great many special preparations of this sort are injurious, producing a corrosive or rotting action on the battery plates, thus reducing the voltage and capacity of the cells.

S. K. Lessey
The Electric Storage Battery Company

EDITORIALS

Some Facts About Box Car Floors

Questioned about box-car floor life, first cost, maintenance cost and possible improvements, a responsible car department officer recently said: "We have some box cars which were built in 1948 and 1949 in which wood decking was applied. This decking was 1¾-in. by 5¼-in. tongue and groove, B or better fir, straight grain. The car also had two intermediate Z-bar stringers on each side. We are receiving quite a number of these cars from foreign lines where the decking has been broken in a number of places, no doubt due to extremely heavy trucks having been used while the cars were loaded or unloaded. In my opinion, it is doubtful whether a complete new wooden floor in a box car will last five years."

In this connection, a recent study by *Railway Mechanical and Electrical Engineer* showed an average floor life of four to six years, with installation cost of $150 to $300. The car officer referred to first cost as follows: The average cost of installing a car floor is $225 per car for material and $29.40 for labor. This is for a 40-ft. 6-in. box. These figures are based on new car production, 20 cars per day. The labor on renewing floor in an old car, which includes cost of removing old decking, is about $43 a car. The figures which I am giving you are based on work done in one of our larger shops. The labor charge naturally would be considerably more on an average repair track, due to lack of facilities.

The *Railway Mechanical and Electrical Engineer* study showed an average repair cost for car floors of $20 to $60 per car per year which was decidedly less than this particular car man's estimate of $100 per car per year. His comment regarding the desirability of modern improvements was pointed and unequivocal. "I am definitely convinced that any railroad is justified in installing improved floor materials or designs, because the saving in maintenance on some of the improved floors in a very few years will offset the additional cost."

Making a Test The Most Effective

An interesting departure from the usual practice of testing certain items of repaired car and locomotive equipment by subjecting them to high pressure before return to service can be observed at scattered points along several railroads. The general procedure involved is to substitute, for the short test at high pressure, a prolonged test at medium pressure. Experience has shown that this method has merit in detecting leaks that might otherwise have gone unnoticed.

There has not been enough experience gained or evidence accumulated on the value of prolonged lower-pressure testing to justify recommending the procedure generally. It is likewise early to recommend industry-wide adoption of this method of testing even one specific part, when perhaps only one shop on one road has found it to be superior. But the general idea appears worthy of investigation.

Even where the prolonged low-pressure test gives results only equal to those of the higher pressure test, there remains another possible reason for considering its adoption. That reason is that it is entirely possible that a part which would perform satisfactorily for a normal term of service at normal pressure might fail when subjected to 1¼ or 1½ times working pressure. However, it is readily admitted that this can be countered by an equally logical argument that if a part is not strong enough to stand an above-normal pressure before entering service, it stands a good chance of failing at working pressure after a year or so of service.

Prolonged low-pressure testing, like anything else that offers a chance of reducing failures on the road, should receive attention because of the need and the value of keeping equipment moving, whether that equipment be an expensive diesel locomotive or a humble freight car. If it proves better and more realistic for testing only one part out of every ten the time spent in determining what that one particular part is will have been well worth while.

In the final analysis, the whole question boils down to one in which only experimentation and experience will give the answer.

Save Your Copies

Starting with this issue, the *Railway Mechanical and Electrical Engineer* will publish a series of articles on the maintenance of the electrical equipment on diesel locomotives. A large proportion of all the apparatus on a diesel is electrical. It is also true that a large part of the men in railroad shop service have a mechanical, rather than an electrical background. The articles are written in simple, colorful language which will permit the man with no electrical experience to understand the things he needs to know about a diesel-electric locomotive.

The articles are also written for the electrical man. Although he knows a lot about things electrical, the diesel is a specific problem which differs in many ways from others in the electrical field. By means of these articles,

he can review things that he knows, and became familiar with their application in this particular field. He will also discover that there are many things with which he is not familiar. Even the manufacturers themselves are constantly finding new ways of applying known factors to improve their product.

The articles will give the why, as well as the how, and when the why is known, the how is much easier to understand.

The first article may be something of a hurdle for some of our readers. It explains the function of motors and generators by comparing them with better-known and more easily understood mechanical devices. It shows what happens when an armature coil moves in a magnetic field and it explains the difference between series and parallel connections. If the reader takes time to really understand this article, the rest will be relatively easy.

The second and third articles will deal respectively with the theory and practice of motor suspension bearings, and of roller bearings and gears. The fourth will cover running maintenance of commutators, and they will go on through all phases of diesel electrical maintenance.

If you will keep your copies, you will eventually have a reference book which, we believe, you will find of great value. The series cannot take the place of the diesel locomotive schools, but it will supplement the work they are doing and, we believe, it will fill a need of long standing.

NEW BOOKS

HEATING, VENTILATING AND AIR CONDITIONING GUIDE. *1951 Edition. Published by the American Society of Heating and Ventilating Engineers, 51 Madison avenue, New York 10. 1,456 pages; Fabrikoid binding. Price, $7.50.*

The arrangement of chapters in this 29th edition remains the same as in the preceding edition. They are grouped in sections under the headings Fundamentals, Human Reactions, Heating and Cooling Loads, Combustion and Consumption of Fuels, Systems and Equipment, Special Systems, and Instruments and Codes. The Technical Data Section has 24 additional pages, but an even greater quantity of new material because of the space saved by concentration and condensation of previous technical text. The section has reference material on the design and specification of heating, ventilating and air conditioning systems based on Transactions, the investigations of the Research Laboratory and co-operating institutions, and the practice of the members and friends of the society. A Manufacturers' Catalog Data Section contains essential information concerning modern equipment.

INDUSTRIAL INSTRUMENTATION. *By Donald P. Eckman, College of Engineering, Cornell University. Published by John Wiley & Sons, Inc., 440 Fourth avenue, New York 16. 396 pages, 5½ in. by 8½ in.; cloth bound. Price, $5.*

The principles of measurement methods employed in industrial processing and manufacturing are reviewed in this book which brings theory into line with practice. The method rather than the mechanism receives the primary emphasis. The fundamentals of physics (mechanics, thermodynamics, and electricity) pertaining to the probems of measurement are reviewed (1) to focus attention on the fundamentals of engineering, and (2) to induce a more analytical and less empirical approach to the problems of measurement. Composition analysis instruments and methods are treated in a chapter that covers emission and absorption spectroscopic analysis, mass spectrographic analysis, and other important methods. Methods of applying instrumentation to process are presented with the arrangement and selection of instruments and controllers, process analysis, and supervision of instrument equipment. Also covered are high vacuum instrumentation, and instruments for mechanical measurements, such as displacement gages, strain gages, force meters, velocimeters, and accelerometers. Schematic diagrams of operation principles and meter installations are given, and over 150 problems included.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. *Pubished by the Lincoln Electric Company, Cleveland 1. 1,200 pages, 5½ in. by 8¾ in., illustrated. Price U. S. A. $2; elsewhere, $2.50.*

Incorporated in this Ninth Edition of the Procedure Handbook are new techniques, new electrodes, and much new design information on the uses of arc welding developed since the publication of the Eighth Edition in 1945. The book, completely revised and re-edited, is intended as a reference handbook for the executive, designer, engineer, shop supervisor and welding operator. In its editing consideration was also given to its use as a text in schools and colleges. All helpful information from previous editions has been included, but in a consolidated form. In its eight parts are discussed Arc Welding History Processes, Equipment and Nomenclature; Weldability of Metals; Techniques, Procedures, Speeds and Costs for Welding Mild Steel; Basic Design Data for Welded Construction; Machinery Design with Arc-Welded Construction; Designing of Arc-Welded Structures; Inspection and Testing of Weld Metal and Welding Operators, and Miscellaneous Applications of Arc Welding in Manufacture, Construction and Maintenance.

NEW DEVICES

Horizontal Boring And Milling Machine

The Bullard Company of Bridgeport 2, Conn. has announced a new four-way bed Bullard horizontal boring, milling and drilling machine offered in four-inch and five-inch spindle sizes. Both machines have 24 spindle speeds. On the four-inch machine the range is from 8 to 1,000 r.p.m. and on the five-inch machine the speed range is from 7 to 850 r.p.m.

This machine is designed with a heavy box type, four-way bed to assure a high degree of productive ability with maintenance of accuracy. This bed supports equally on four ways a heavy ribbed box type saddle and table. The ways are covered by stationary sheet metal guards. Replaceable non-metallic bearing surfaces are used under both saddle and table.

The table is of box-type construction, heavily ribbed, longitudinally and transversely. As in the case of the saddle, non-metallic way surfaces are used. The cross feed nuts revolve in pre-loaded anti-friction bearings which are adjustable for wear. The table is clamped to the saddle by two equalizing clamps operated by a single lever at the front end of the table. Table and saddle mechanisms run in oil and the ways are lubricated by the Trabon lubrication system.

The spindle carrier ways are an integral part of the main head casting and gibs are used for wear compensation. The head is supported on 24-in. ways which run to a height of 29 in. The head ways are six inches by three inches and in addition there is a narrow guide 29 in. by 6 in. adjacent to the lead screw. All gears, bearings and shafts are lubricated by filtered oil circulated by two rotary pumps. The filter elements are renewable.

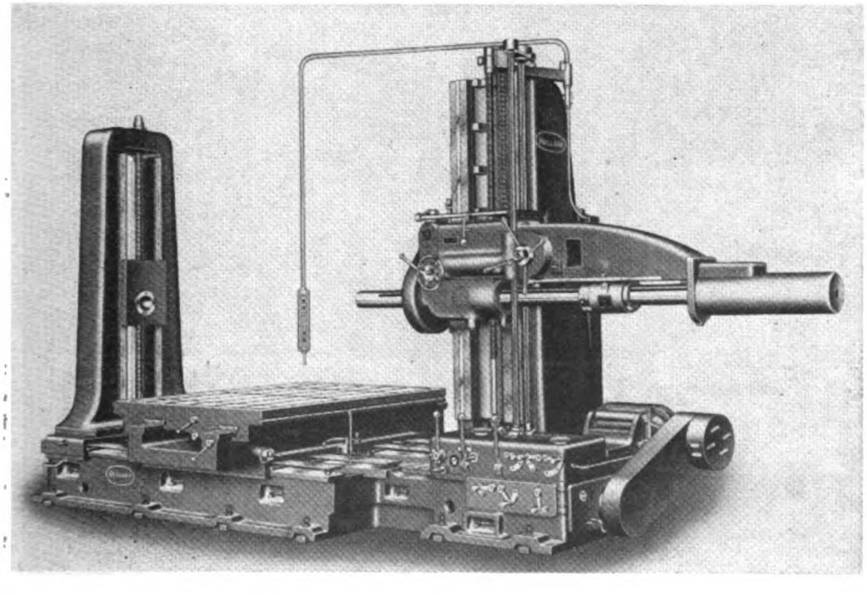
A submerged pump in the large reservoir supplies filtered oil under pressure to all gear contacts and bearings. The spindle sleeve and other head gears and bearings are not operated in an oil bath but are under pressure jet lubrication. In this system, after the oil has been used it is returned to a sump by a second, or scavenging, pump to be refiltered and recirculated by pressure. The use of the system enables the quantity of oil to each point to be controlled and eliminates the generation of heat in the oil by hydraulic churning. Exterior lubrication of all sliding surfaces and bearings is accomplished by the "One-Shot" system.

One of the more important elements in the horizontal boring machine is the spindle sleeve. In this machine the steel bull gear is bolted to the rear of the face-plate flange on the spindle sleeve. By locating the bull gear in this position, a direct drive is provided for large diameter milling cutters without the necessity of transmitting torque through the sleeve. The bull gear is 18 in. in diameter and is in one solid piece weighing 400 lb. This weight, plus the mass of the spindle, gives the flywheel effect desirable with cemented carbide milling cutters. The spindle sleeve bearings are Timken preloaded roller type. Two bearings are used close to the spindle sleeve face plate. The rear bearing of the spindle sleeve is also a Timken bearing. Lubrication is provided by forced feed through several pressure jets between the bearings.

The 29-in. over-all length of the spindle sleeve and the front and rear spindle sleeve bushings are of deep-hardened ball-bearing steel. The gears throughout the spindle drive are the helical type. The speed and feed boxes are assembled as a self-contained unit mounted directly on the bed. The interlocking mechanism provides more than one feed unit such as head, table and saddle, being engaged at the same time. For safety, rapid traverse, available to all units, is in a direction always opposite to that selected for the power feed. There are 24 feeds in inches per revolution of the spindle, for each feed in both fast and slow gear positions of the spindle, making a total of 48 feeds. The feed range is from .0002 to 1.550 inches per revolution.

The speed box is of constant mesh helical gear drive design in conjunction with which sliding internal gear tooth clutches are used rather than sliding gears for changing speeds. The gears run in a pump-circulated oil bath. Push button controls in the pendant station prevent operation of the machine before starting the lubrication pump and a pressure switch automatically stops the machine if the oil pressure drops below the pre-determined setting.

These machines are equipped with a hydro-dynamic coupling and brake motor driving through multiple V-belts. The machine is driven by a 25 h.p. enclosed, fan-cooled, Brake type motor.



Plastic Battery Plate Separator

A new plastic battery separator is announced by The Electric Storage Battery Company, Philadelphia, Pa. Called Pormax, the separator is a polyvinyl chloride synthetic, and is made solely from raw materials found in abundance within the United States.

Separators should be made from highly porous, acid-resistant, and non-oxidizable materials. Port Orford Cedar or Douglas Fir wood is commonly used to make separators for automobile batteries. The higher grade batteries use rubber or glass separators because of their better resistance to electrolyte attack and oxidation. The manufacturer states that the Pormax separator is very porous, non-brittle, and more acid-resistant than either wood or rubber separators and that because of this, it substantially increases battery life.

For the last five years company engineers have been testing and improving the separator. Two years ago, a pilot plant was set up at Stokes Molded Products, Inc., Trenton, N. J., a subsidiary of The Electric Storage Battery Company, to study and develop techniques for mass producing Pormax. Special machinery had to be created for this purpose. When production is expanded, first priority will be given to the armed services. However, as expansion proceeds, Pormax separators will be available for Exide batteries in civilian use.

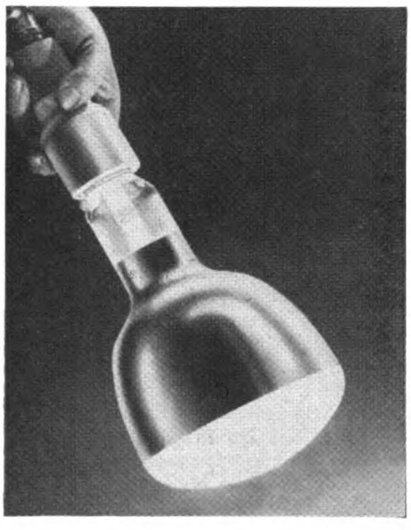
Air-Drying Protective Coating

A new plastic coating has been developed to protect tanks, tank cars, pipes, fittings, structural steel parts and chemical processing equipment against attack by splash, drip and spray from corrosive chemicals, corrosive atmospheres, weathering and rust. It will be marketed under the name of U. S. Royalguard protective coating.

The plastic compound introduced by the United States Rubber Co., New York 20, combines high film flexibility with good adhesion and impact resistance. It will not chip or crack and can be used on steel, aluminum, concrete, hardwood, or composition board. It is applied by spray, allowing one hour drying time between coats and 24 hours drying time after the final coat. It requires no primer and can be produced in a variety of colors.

A sharp instrument will cut through the film but the break can be repaired easily by touching up with brush or spray. Metal should be grit or sand-blasted before the coating is applied, cement should be etched with hydrochloric acid, while wood and composition board needs rough sanding to assure a good bond.

◆



High-Bay Reflector Lamps

Two high-wattage industrial lamps with built-in reflectors for use in the lighting of high-bay shops have been announced by General Electric's Lamp Department, with headquarters at Nela Park, Cleveland, Ohio.

Because almost no dirt collects on the bottom of the bulbs, the only place where light is emitted, the new lamps are said to be especially desirable for use in places in which dirt collection normally causes severe reductions in light levels. They are seen as especially advantageous in high-bay areas where lamps can be reached for maintenance only at high cost, or interfere with shop operation by tying up a crane.

Produced in both 500- and 750-watt sizes, the lamps employ a new bulb design, the R-52, having a special contour to distribute the light downward for effective use in the working areas, and a cutoff to give reasonably comfortable brightness down to 35 deg. below the horizontal. The lamps measure 6½ in. across the face, and 11¾ in. in length. The base is of the mogul screw, mechanical type, and the lamps are designed to be burned base-up, or within 25 deg. of that position. The bulbs should not be touched by accessory equipment, and should be protected against falling water.

The R-52 lamps give substantially even illumination when the spacing between units is not greater in distance than the mounting height. The amount of light delivered at working levels compares favorably with that provided by industrial luminaires of the focusing type. Downward candlepower, within an 80-deg. cone, averages approximately 4,000 for the 500-watt lamp and 6,000 for the 750-watt size. Much early use of the new lamps is expected in existing fixtures, and especially in those having reflectors which have deteriorated from age, chemical corrosion, or accumulation of dirt and grime. This shielding will serve to protect the lamps from mechanical and water breakage.

◆

Hydraulic Pipe Bender

The model 800 semi-automatic hydraulic bending machine made by the Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago 14, is a compact bending machine 21 in. wide by 34 in. high by 17 in. long, with power well beyond its capacity of 1¼ in. O. D. by No. 16 B.W.G. steel tubing or 2 in by .093 in copper or aluminum tubing with a yield point up to 12,000 p.s.i. The unit is powered by a standard 2-hp. 220/440-volt, 3-phase, 60-cycle motor furnished with the machine.

It is operated by a single lever which when pushed down causes the bending arm to swing around to the degree of bend selected and stay there until the operator has removed the bent part; then the lever ls moved up and the arm swings back to its original position.

The bending die is held on by spring clips for easy changing. This die is a combination die with four defferent sizes, one to each side.

The bender can be changed sinbply and easily from a right-hand to a left-hand bender by changing the pressure and clamping arms over and inserting the bolts into holes ready for that purpose.

It is all welded construction, and the 10 in. steel cylinder to which the top and base is welded to is also the tank containing the hydraulic fluid.

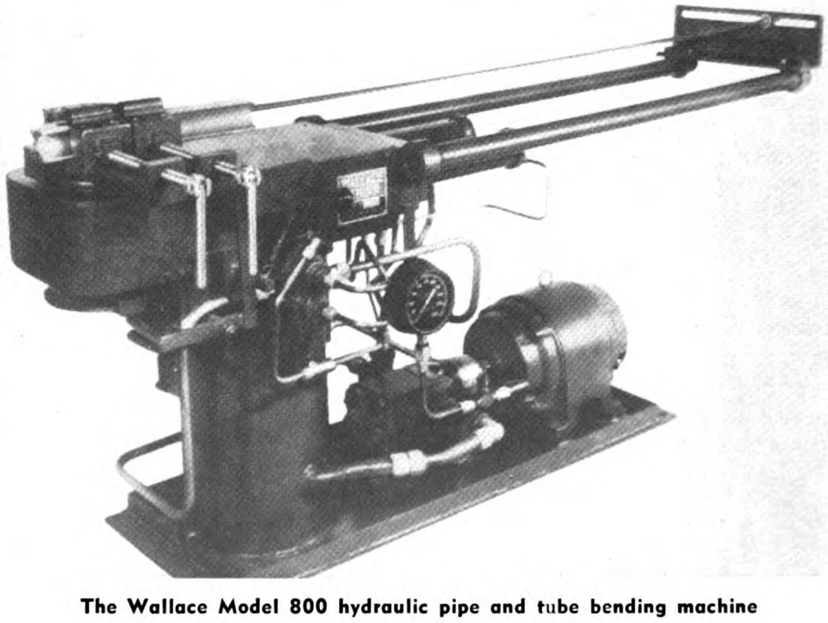
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Piston Lift Gravity Drop Hammer

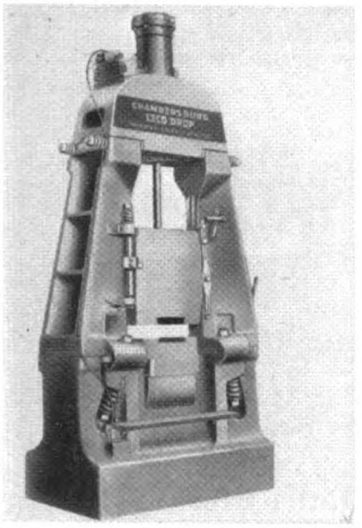
A new model of the Ceco-Drop, a piston-lift, gravity drop hammer has been designed for the production of work requiring short, snappy strokes, permitting faster, more accurate production. Known as the Model C, it was introduced by the Chambersburg Engineering Co., Chambersburg, Pa.

Often, work of this nature makes it necessary to wipe or polish the top die after a certain number of strokes. To provide for this, the device has a safety rest attached to the frame which can be swung into position under the ram when elevated.

Stroke of the unit is controlled by quick positioning dogs mounted on a pivoted rocker which in turn is connected to the operating valve. A shock absorber con-



The Wallace Model 800 hydraulic pipe and tube bending machine



nected to this rocker neutralizes shock and vibration.

Where it is desired to change from long stroke to short stroke or vice-versa, the Ceco-Drop Short Stroke Control may be attached. This is an air operated dog controlled by a push-button on the treadle. Pressure on the button changes the kind of stroke while release of button converts or reverts to the standard stroke.

This unit has a 20 to 1 anvil where the anvil is twenty times the weight of the ram. It is also available in a 15 to 1 ratio where specified.

◆



Lightweight Arc Welders

A series of three Wilson Bumblebee arc welders of 300, 400 and 500 amp. capacity respectively have been introduced. All models have sturdy construction, are compact and lightweight. Features, according to the manufacturer, include instant arc starting, wide current range, easy-to-operate controls and minimum maintenance. The units are available from the Air Reduction Sales Co., Division Air Reduction Co., Inc., New York 17.

Automatic hot-start control with arc stabilizing capacitors are provided on the 300 and 400 amp. models. Current ratings are 60-375 for the 300 amp. unit, 80-400 for the 400 amp. model and 100-675 for the 500 amp. machine.

Incorporated in these units is silicone insulation which increases safety in two ways: it operates safely at high temperatures without breaking down and is water repellent. Also the light weight resulting from the use of silicone insulation makes these models ideal for mounting on running gear for portability. There are no rotating parts, with the exception of the fan on the 400 and 500 amp. models.

◆

Single Spindle Boring, Drilling, Milling Unit

Speeds from 10 to 1,300 r.p.m. in fine increment through 45 changes provide the new single-spindle machine with specific metal working advantages.

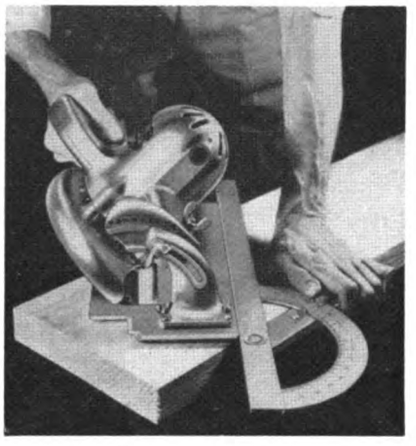
This machine tool was designed by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., to meet the urgent production requirements that demand continually faster cutting speeds, heavier cuts, better finishes and greater accuracy.

A 4 in. diameter nitralloy steel spindle having a travel of 30 in. is furnished. Rotating on anti-friction bearings, speeds up to 1,300 r.p.m. are possible. Positive machine settings to close limits are possible with the quick-acting, electrically operated positioning device.

An electric push-button control station having forward-reverse-stop-and-inch buttons is provided in a swiveling pendant. This control box can be swung in a semicircle to any position.

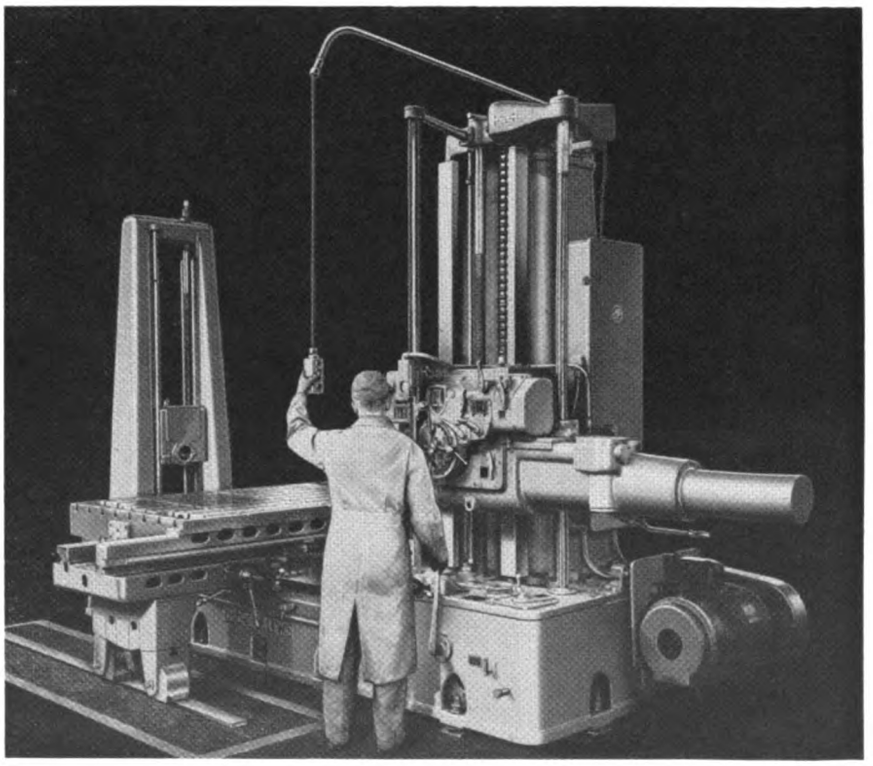
A simplified gear change requires only two hand cranks. The operator may select any of the 45 spindle speeds without the necessity of reading a complicated chart.

◆



Power Saw Protractor

A practical Saw Protractor for use as a guide in power sawing operations has been introduced by The Black & Decker Mfg. Co., Towson 4, Md. By using this unit, the operator may cut practically any angle accurately and easily.



The device is constructed of metal for rigidity, yet it is very light, weighing only 1½ lb. It consists of a straight edge, a segment clearly calibrated in units of 1 deg., and an easily movable holding arm. The desired angle can be set by merely loosening a wing nut on the under side of the holding arm and moving the arm until the indicator points to the correct degree mark. Its wing nut is then retightened to prevent slippage of the holding arm.

The saw protractor is particularly useful for compound mitre cuts when used in conjunction with the bevel adjustment on most power saws. It can also be used for laying out any carpentry work involving angles. Its use is adaptable to practically all portable electric saws.

◆

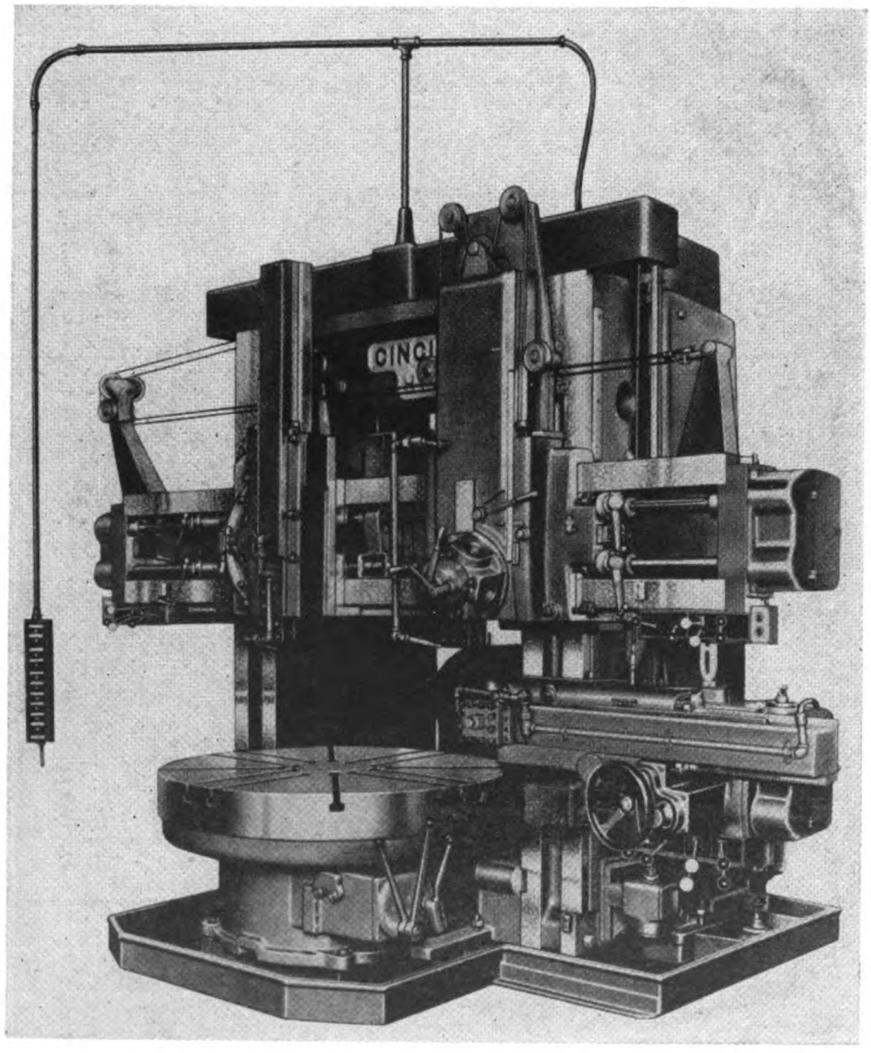
Vertical Boring, Turning Mill

Design improvements have been incorporated in all new Hypro Vertical Boring and Turning Mills by their manufacturer the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. These features include nonmetallic bearings for ram and saddle; independent traverse motors for rail and side-heads; swivel type pendant control; helical rack and pinion on the ram; marked feed controls; anti-friction bearing table transmission; 16 feed gear box; two arrangements of mechanical change gear drives and three electrical arrangements for single shaft drives.

To assure positive power to various machine heads, independent traverse motors are used. They respond instantly for complicated drive shafts and transmission units have been eliminated. The pendant control swivels to any likely work position, enabling operator to watch part being machined with safety.

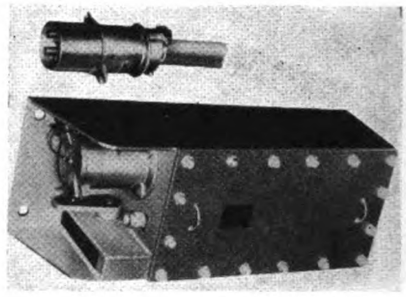
A new feed box provides 16 feeds from 0.003 in. to 0.500 in. on the 54 and 64 in. machines and 0.004 in. to 0.750 in. on the 6-ft. or larger standard and heavy duty mills.

Two arrangements of mechanical change gear drives are available. In the 16-gear change main drive, table speed variation is obtained through 16 mechanical gear changes. Power for this drive is obtained through a 1,400 r.p.m. 40-50 or 60 hp. a.c. motor depending upon needs. A similar drive unit but having 4 gear changes requires a 40 or 50 hp. adjustable 3 to 1 speed d.c. motor for table speed variation. Motor speed is controlled with a rheostat.



With a 3 to 1 heavy-duty adjustable voltage drive, table speeds from 20 to 1 in two separate ranges are possible.

◆



Outlet Breaker For Docks and Piers

Pier outlet breakers, offering a simplified standard method of supplying auxiliary power to ships at any dock or base, are available from Westinghouse Electric Corporation. They can be placed along docks or piers, providing full protection for power cables and convenient disconnects.

The units use Westinghouse type AQB circuit breakers of class HI design, in accordance with Navy Department specification 17B1 (INT.), covering air circuit breakers, electric, for shipboard use. These outlet breakers are available for either 250-volt d.c. or 440-volt a.c., two- or three-pole service, with trip ratings from 70 to 600 amp. If more power is required, the units can be installed in groups.

Power from the breaker is fed to a standard watertight receptacle capable of interrupting its rated load. Receptacles can be supplied for either three- or four-wire service.

The enclosure is made of ¼-in. steel plate, seam-welded to provide watertight construction. Extended enclosure ends prevent fastening hawsers to the unit. The unit is electroplated with cadmium and tin, and then sprayed with aluminum paint for maximum protection against salt air and water.

The enclosure is provided with a Navy-type, heavy-duty indicating light. Heaters inside the unit minimize condensation. A terminal board is provided inside the unit for pilot light and heater connections.

◆

Single Use Molds Reduce Casting Costs

In the production of Meehanite metal machine parts cast by the Croning process, an average of 30 to about 40 per cent of normal machining time can be saved. This process employs thin, shell-like single use molds made of sand bonded with Bakelite phenolic resins. The mixture of sand and resins is applied to the surface of a heated metal pattern, then baked hard to form half of a mold.

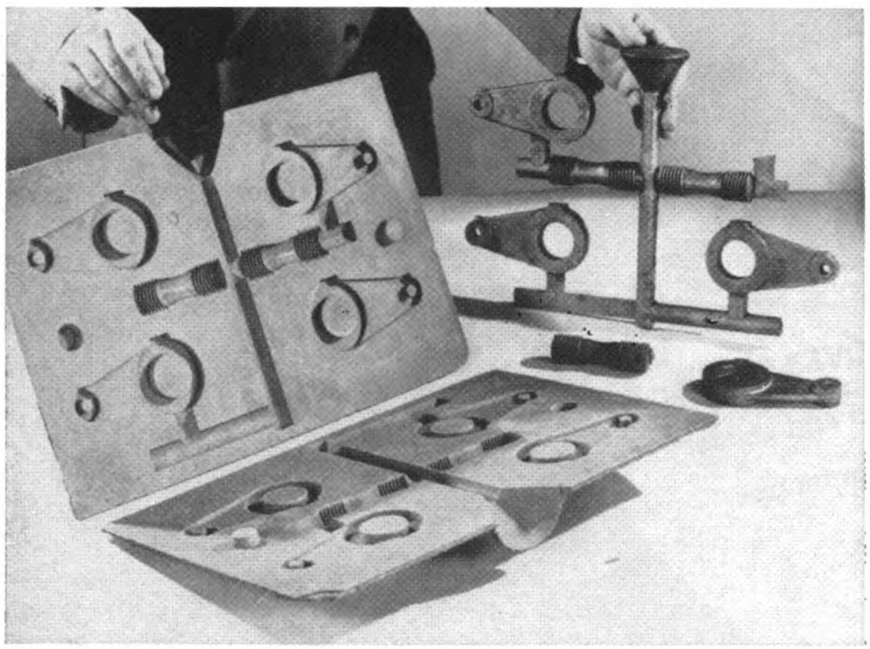
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Clamped together, the two halves of a mold shown in the top portion of the illustration, are placed in a flask, surrounded by steel shot or other bedding material and the metal is cast. Smooth surfaces produce castings to tolerances of 0.002 to 0.003 of an in. per in., drastically reducing finishing operations.

A connecting rod, top left and left side of bottom photo, cast by the method was drilled, ground and cleaned in 30 per cent less machining time than is required for a similar crank, right side of bottom photo, cast by ordinary sand mold methods.

Similarly, a crescent guide for threads, top right and bottom right of illustration, on a textile machine required 39 per cent less machining time when cast by the new process.

The use of phenolic resins, product of the Bakelite Co., Division Union Carbide & Carbon Corp., New York 17, is a contributing factor in this economical method of producing more perfect castings.

◆

High-Speed Drum Cleaning Units

Two Rotoblast drum cleaning machines, models ES-400 and ES-382, which simplify and speed-up the removal of dirt, rust, paint and other foreign materials from 30 and 55 gal. returnable steel drums and lids before reuse, are available from the Pangborn Corp., Hagerstown, Md.

Metal abrasive, hurled against both the interior and exterior surfaces of the drum by centrifugal force, scours the metal, leaving no chemicals or alkalies to wash off, and provides a clean bonding surface for repainting.

The model ES-400 is designed to clean 1,000 to 1,100 drums and drum heads a day, while the other unit will clean 320 to 560 drums and covers per day.

In cleaning operations, metallic abrasive is thrown against the surfaces by the vaned wheels, which revolve at 2300 r.p.m. The cleaning cycle takes from 50 to 90 seconds depending upon the nature of the material to be removed, and the facility with which the operator loads and unloads the drums.

Drums are handled differently by the two machines during the cleaning operation. The larger capacity model, ES-400, consists of a table divided by a partition. On either side of the partition are holders for the drums to be cleaned. While one drum is being cleaned in the cabinet, the other is exposed for unloading the cleaned barrel and loading the next drum to be cleaned.

The smaller machine, consists of a cabinet, inside of which are a table and rollers. The operator places a drum on the table, and the drum cover is placed on rollers provided. He closes the door and pushes the starting button. The cleaning proceeds automatically while the operator brings up the next drum for cleaning.

Spent abrasive, mixed with the material it has scoured from the drum, is cleaned of all dirt and broken particles by a separator and returned to the machine for reuse.

◆

Carbon Dioxide Systems Weighing Device

Of utmost importance to guarantee proper operation when a carbon dioxide fire fighting system is activated is the correct weight of charge in the cylinders. To simplify this task, the American-LaFrance-Foamite Corp., Elmira, N. Y., has engineered a weighing device which requires but a minimum of effort.

Without taking the system out of service, the operator is only required to loosen the clamp bolts holding the cylinder, insert a fulcrum under the neck of the valve, press hand lever until the cylinder clears the floor and read the scale for the correct weight.

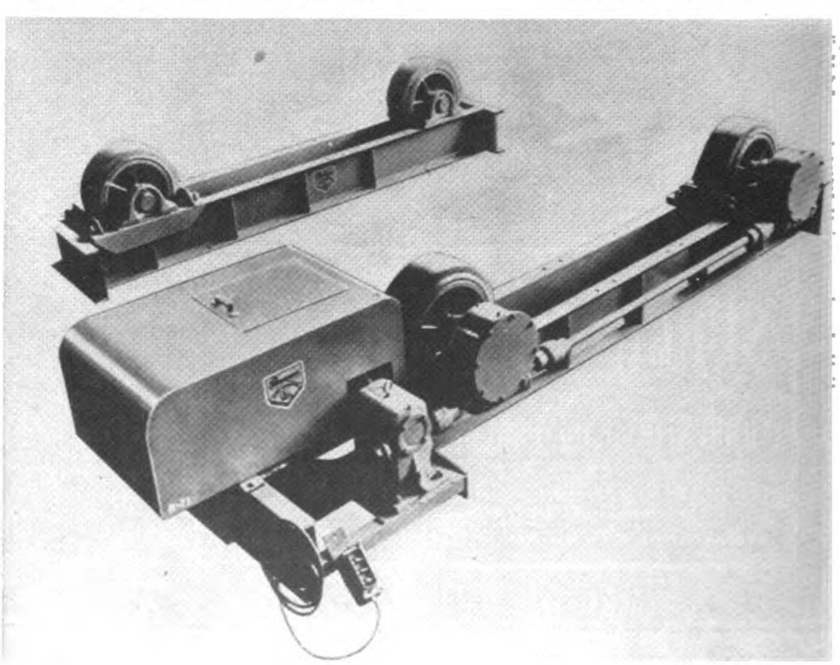
The system is light in weight, weighing only 28 lb. It is constructed of channel iron to give added strength and its scale has a capacity for weighing up to 200 lb.

◆

Motor Driven Turning and Idler Rolls

Since turning rolls are needed to weld large cylindrical vessels, tanks and drums, the Worthington Pump and Machinery Corp., Harrison, N. J., has developed and im-

(*Continued on page 88*)



Piston life in the first General Motors Diesel locomotives averaged 25 to 50 thousand miles. That's been increased through the years beyond 600 thousand miles, due to improved design and materials and better lubrication.

What advances the future will bring are already apparent in the present performance of these locomotives and the way they are helping to meet growing demands upon the railroads today.

GM DIESELS ARE THE BEST RAILROAD SECURITY

ELECTRO-MOTIVE DIVISION

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Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ont.

(*Continued from page 84*)
proved both their motor-driven rolls and idler rolls.

With rubber-tired rollers, the model 75PR has a turning capacity of 75 tons distributed on one power roll and two idler rolls. With steel rollers, its turning capacity is 150 tons distributed on a power roll and five idlers.

Motor-driven rolls are driven through an enclosed variable speed unit, having a range of speeds to meet individual job requirements. The outboard roller unit is adjustable at appropriate center-to-center distances between rollers allowing the handling work of various diameters.

Machines are equipped to meet customers' voltage requirements. A magnetic across-the-line starter is standard with a push-button mounted for remote control operation.

The Worthington model 75IR idler roll is mounted upon a self-aligning pillow block and equipped with a shaft and roller as an integral part. Its fabricated steel rollers can be either plain or rubber-tired.

◆



Battery Water Unit

A new and refillable ion-exchange unit, known as the Filtr-Ion, for delivering water equal in chemical quality to triple-distilled water from an ordinary faucet, has been announced by the La Motte Chemical Products Company, Baltimore 4, Md. Designed for small-quantity uses were more elaborate equipment would be impractical, it provides water of extremely high quality for storage batteries. The tube is 8½ in. long and 1⅝ in. in diameter, made of transparent plastic material, and is filled with Amberlite ion exchange resins. Small holes in the top cap prevent excessive flow through the bed of resins, and deionized water is delivered through a small plastic tube. The tube is not intended to remove bacteria or impurities which are not ionized, the manufacturer asserts. As water passes through the apparatus, however, metallic and other ionic solids are taken out of solution by the mixture of anion and cation exchangers.

Fiberglas filters trap physical impurities. The Amberlites change color when they become exhausted. Initially blue-black, the bed of resin turns light yellow in a gradually descending line as exhaustion progresses. When the yellow band reaches the bottom, the unit is refilled. Refill packages contain sufficient resins for two complete refills, and include new filter elements as well.

◆

Locomotive Speed Indicators and Recorders

Redesigned models of their line of locomotive speed recorders, speed indicators and engine operations recorders have been introduced by the Barco Mfg. Co., Chicago 40.

Major improvements include built-in-lighting which replaces external bracket type lights and results in more compact overall dimensions of the devices. Introduction of new tooling procedures for the manufacture of the operating mechanism contributes to higher accuracy and interchangeability of parts. No change has been made in the basic mechanical mechanism of these instruments which are offered in two principal speed ranges, 0 to 75 m.p.h. and 10 to 120 m.p.h.

Optional features offered with the Dieselometer unit or diesel locomotive operations recorder, are the recording of dynamic braking and wheel slippage. Prevention of wheel slippage is important in operations because of the usual excessive wear on wheels and the high cost of repairs.

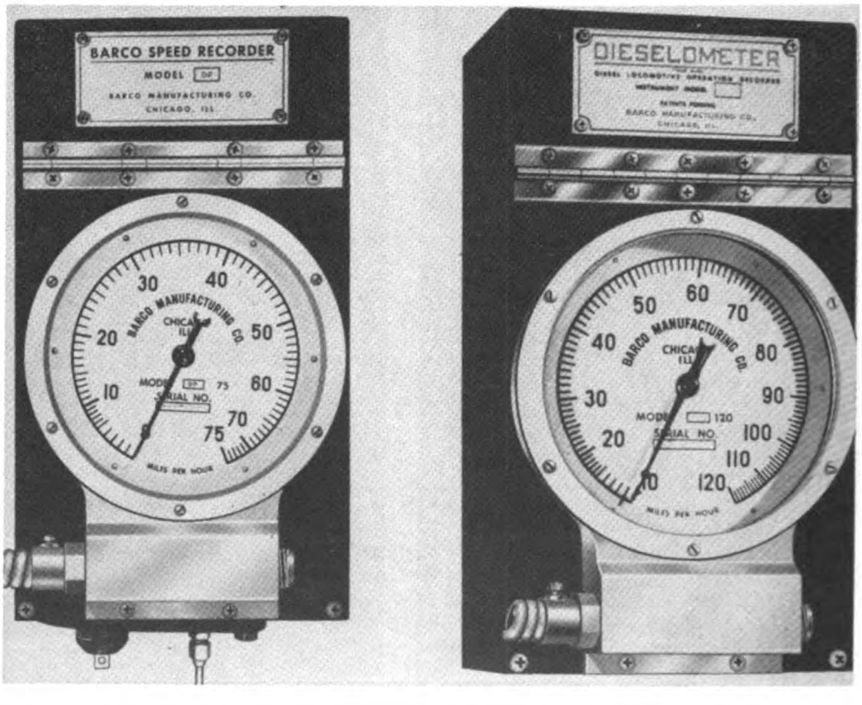


Riveting Hand Guns

In order to increase the utility of their hand guns, several design and construction modifications have been introduced by the Cherry Rivet Co., Los Angeles, Calif.

The new G-11 gun, to the right in the illustration, was redesigned to eliminate undue wear on ratchet teeth caused by accidental release of the draw-bolt. A triangular-shaped trip plate, mounted above the lever pin, now prevents this release unless the handles of the gun are pulled all the way apart.

With the G-36 gun, screw-on type pulling heads are employed which are interchangeable on other models. This standardization increases the capacity of the tools and increases the service life and allows easier operation.



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AZY

THE BRUSH GRADE FOR DIESEL-ELECTRIC TRACTION MOTORS

Broken brushes . . . . NO!

Shunt failures . . . . . NO!

Fine commutators . . YES!

plus SUPERB BRUSH LIFE!

● These statements are *facts*. Grade AZY brush is better than any brush ever applied to diesel-electric traction motors as proved by twelve million miles of rugged, on-the-job testing. Never before has there been a grade – GRADE AZY – combining physical strength with long life at high speeds without commutator wear.

This brush has a special, no-fray shunt cable. It has a unique, vise-tight shunt connection.

This brush is it, and you can get it, under National's unique standardization program, for the same low, flat price, whether you buy 1 box or 10,000 boxes. You get the best brush money can buy and you save money in the bargain. For complete information, write to National Carbon Company, A Division of Union Carbide and Carbon Corporation.

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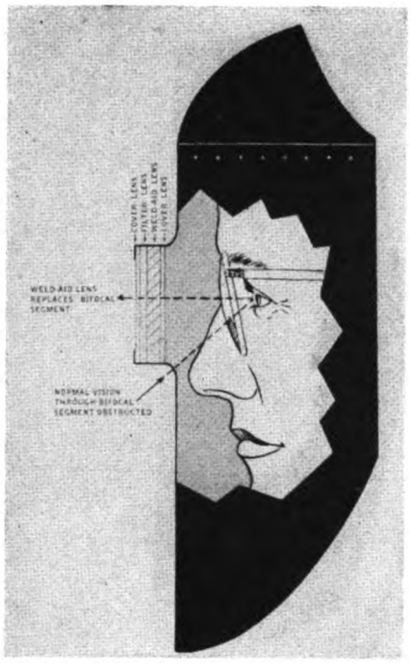
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With the revolutionary new "Eveready" No. 1050 Flashlight Battery, you get these big exclusive features:

- More than twice as much light
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Why? Because of "Eveready" No. 1050's exclusive "inside out" construction. Instead of being the container for the cell, the zinc electrode is on the inside to make the battery last longer, while the new outside carbon jacket makes the battery leakproof. *Order a supply of No. 1050's today.*





Welder's Optical Lens

An opitcal aid for welders who wear bifocal glasses has been developed. The device, manufactured and marketed by Willson Products, Inc., Reading, Pa., under the trade name Weld-Aid Lens, is designed to help operators who depend on bifocal glasses for near vision. Since the vision slit of the welding helmet is placed for looking straight ahead, it does not permit use of the bifocal segment and welders who wear this type of glasses frequently suffer blurred vision, eyestrain and headaches which seriously reduce their productivity and skill.

This lens corrects the condition by supplying clear near vision over the entire area of the window in the helmet, thus replacing the unusable segment power of the welder's prescription glasses.

The lens consists of high grade optical glass ground to a specific power and mounted securely in a durable plastic frame which fits easily into the average welding helmet. It is available in two sizes, 2 x 4⅛ in. and 2 x 4¼ in. and in five powers: 0.75, 1.00, 1.25, 1.50, and 1.75. To protect the Weld-Aid from front and rear pitting, it is recommended that it be placed between the cover and filter lenses.

◆

Multiple Operation Boring Machine

The Ex-Cell-O Way Type boring machine is a combination unit on which parts can be machined from two directions simultaneously, holding accurate relationship between the operations and minimizing loading and handling time. Essentially, it consists of one, two, three or four standard way units combined with a center section and equipped with tooling to suit.

The unit accommodates two- and three-cylinder in line refrigerator-compressor blocks and four- and six-cylinder V-type engine blocks.

This boring device introduced by the Ex-Cell-O Corp., Detroit, Mich., precision bores cylinders and crankshaft bearings, holding a 90 deg. angle between the bores within 0.001 in. in 14 in. When operations from two directions are performed, the possibility of error in relocating and reclamping the part for each operation is eliminated.

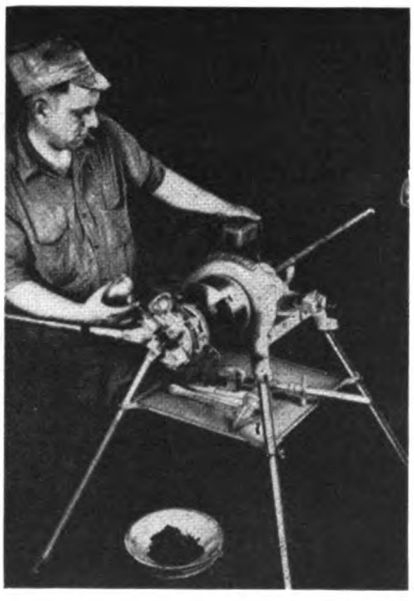
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Tool Tray and Oil Strainer

Recently made available by the Beaver Pipe Tools, Inc., Warren, Ohio, are two items that round out their equipment.

Readily mounted beneath Beaver's Model-C power unit by attaching to legs with bolts and wing nuts is the Tool Tray, the first item. This device with a vertical retaining edge makes it possible for workmen to lay tools and equipment in a handy position beneath the machine.

The second item is the aluminum oil strainer which is placed beneath the power unit over a five-gal. pail. Oil and chips drop into the beveled edge strainer. This keeps oil and chips off the ground or floor. strains oil for use over and over again and accumulates chips for easy disposal.



◆

Gas Cutting Machine

A motor driven, straight track-guided unit has been perfected which will supply precision and simplify gas cutting, flame hardening and welding operations. It is claimed by the manufacturer, Air Reduction Sales Co., Division Air Reduction Co., Inc., New York 17, to be useful for billet nicking, slab ripping, skull cutting and in maintenance shops where flame hardening is used extensively. A feature of the device is a traveling carriage which carries the equipment past the work.

Provision has been made for mounting the Airco Plate Edge Preparation Device, the Universal Motorized Torch Arm and Holder Assembly and the Manual Torch Arm and Holder Assembly on the unit named the Radiagraph. Also, automatic welding units which often require a carriage can be mounted on the equipment.

Salient features include all-welded construction; self-contained electric panel; speed ranges from 1 to 72 in. per min. with standard gear reduction unit; and indexed speed control for manual selection of desired speeds.

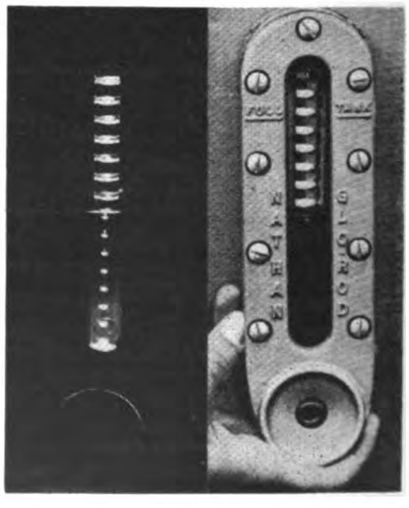
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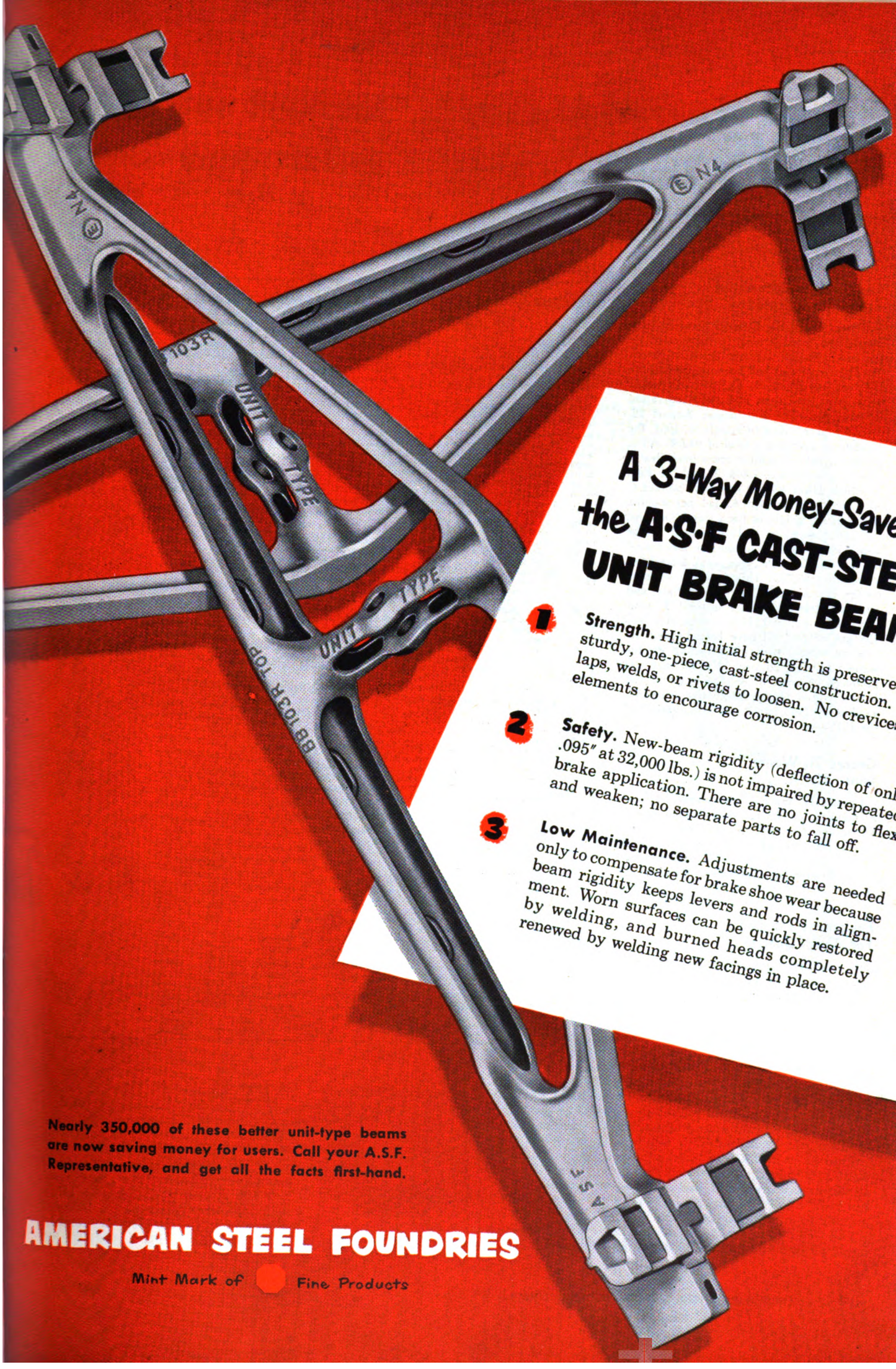
Liquid Level Gauge

The line of Nathan Glo-Rod liquid level gages recently introduced by the Nathan Mfg. Co., New York, adapts an old principle to a new purpose for the increased efficiency of railroad operation. These units use a new version of the principle of light refraction in liquids to provide faster, easier, accurate reading of liquid levels in diesel oil, lubricating oil or cooling water tanks.

They are designed to pipe light from a flashlight or built-in, electric-bulb unit, through a transparent plastic rod which is held vertically in the fluid within the gage body. Shallow holes drilled into the back of this rod appear to the person reading the gage as a series of luminous dots below the level of the liquid, but as elongated horizontal bars above the surface. This makes possible easy noting of the liquid level in the tank.

These gages are recommended for diesel fuel and water tanks up to pressures of 10 lb. per sq. in. and temperatures of 210 deg. F. and for water-alcohol or water-ethylene glycol mixtures. All models are supplied with either a circular target at one end of the gage or a flashlight illumination, or complete with integrated electric bulb ready to plug-in to a standard outlet of 110 volts.





A 3-Way Money-Saver the A·S·F CAST-STEEL UNIT BRAKE BEAM

1. **Strength.** High initial strength is preserved by sturdy, one-piece, cast-steel construction. No laps, welds, or rivets to loosen. No crevices or elements to encourage corrosion.

2. **Safety.** New-beam rigidity (deflection of only .095″ at 32,000 lbs.) is not impaired by repeated brake application. There are no joints to flex and weaken; no separate parts to fall off.

3. **Low Maintenance.** Adjustments are needed only to compensate for brake shoe wear because beam rigidity keeps levers and rods in alignment. Worn surfaces can be quickly restored by welding, and burned heads completely renewed by welding new facings in place.

Nearly 350,000 of these better unit-type beams are now saving money for users. Call your A.S.F. Representative, and get all the facts first-hand.

AMERICAN STEEL FOUNDRIES

Mint Mark of Fine Products

NEWS

Gas Turbine Locomotive Test Data Released

OPERATION of the General Electric Company's gas turbine electric locomotive on the Union Pacific was terminated on March 31. The locomotive had been shipped to the U.P. on July 28, 1949. The first few weeks were spent on a tour, and actual operation in freight service was begun August 22, 1949. From this date to March 31, 1951, the locomotive operated a total of 94,885 miles, produced 344,950 million gross ton-miles of service and burned 1,448,787 gal. of fuel, of which about 95 per cent was bunker C oil. This is an average of 4.2 gal. per m.g.t.m. The average weight of train was 3,356 tons.

Since November 1, 1948, which is the approximate date the locomotive was placed on test in Erie, Pa., the total locomotive miles are 105,732. This includes mileage on the Pennsylvania, the Nickel Plate, and approximately 4,500 miles on the U.P. tour.

Since November 1, 1948, a total of 1,797,426 gal. of fuel oil have been burned, including some power plant testing on the water box when no locomotive mileage was produced. A total of 363,816 m.g.t.m. had been credited to the locomotive from November 1, 1948, until the termination of the U.P. test.

George H. Weiler Joins N.P.A.

GEORGE H. WEILER, who recently retired as manager of the railroad division of the Vanadium Corporation of America, has joined the railroad equipment division of the U. S. Department of Commerce, National Production Authority, Washington, D. C.

Equipment Program For Third Quarter

THE increased third-quarter freightcar program which was announced recently by Administrator James K. Knudson of the Defense Transport Administration was made possible by adjustments in the steel-allocation plan, the allotment of a "little more" steel, and the extension of "direct-assistance" arrangements to the procurement of castings. This was explained later at the Washington, D. C., headquarters of the National Production Authority.

As to the third-quarter car program, Mr. Knudson said he understood it had been stepped up to a 9,500-car monthly basis. Previous information had indicated that the third-quarter allotments of steel and other materials might cut the program to a monthly basis as low as 7,600 cars.

The "little more steel" involved in the larger program was put at 11,000 tons by N.P.A. sources. That would bring the total third-quarter allotment for new-car construction to 683,000 tons. The "adjustments" in the program include some rearrangements of the previously-determined proportions of the different types of steel involved.

As to the third-quarter locomotive program, Mr. Knudson said he understood it had been put on the basis of 275 units per month.

At the request of the Office of International Trade, the N.P.A. has granted the necessary priority assistance to six factories building 160 locomotives for export to 26 countries, The Department of Commerce said the 160 locomotives were at various stages of completion, but shortages of materials had brought production to a halt. Priority assistance was requested because the locomotives are important to "mutual defense."

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of February 1951	Month of February 1950	Two months ended with February 1951	Two months ended with February 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	24,562	21,902	53,438	49,299
3-06	Total, Diesel-electric	18,014	14,696	38,935	29,897
3-07	Total, electric	699	678	1,537	1,443
3-04	Total, locomotive-miles	43,281	37,278	93,916	80,642
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,509	1,249	3,259	2,619
4-06	Empty, total	672	661	1,525	1,455
6	Gross ton-miles-cars, contents and cabooses (000,000)(M-211):				
6-01	Total in coal-burning steam locomotive trains	40,438	30,108	89,301	71,093
6-02	Total in oil-burning steam locomotive trains	10,399	10,732	22,126	21,000
6-03	Total in Diesel-electric locomotive trains	49,383	41,038	107,057	82,801
6-04	Total in electric locomotive trains	1,900	1,658	4,175	3,645
6-06	Total in all trains	102,147	83,543	222,693	178,553
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.04	1.05	1.04
10-02	Loaded freight car-miles	39.10	37.00	38.80	36.10
10-03	Empty freight car-miles	17.40	19.60	18.10	20.00
10-04	Total freight car-miles (excluding caboose)	56.50	56.60	56.90	56.10
10-05	Gross ton-miles (excluding locomotive and tender)	2,645	2,479	2,649	2,458
10-06	Net ton-miles	1,252	1,079	1,248	1,076
12	Net ton-miles per loaded car-mile (M-211)	32.00	29.10	32.20	29.90
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	69.20	65.40	68.10	64.30
14	Averages per train hour (M-211):				
14-01	Train miles	16.40	17.20	16.50	17.20
14-02	Gross ton-miles (excluding locomotive and tender)	42,743	42,103	43,134	41,710
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	42.30	38.30	44.00	38.80
14-02	All	40.30	35.40	42.00	35.90
15	Average net ton-miles per freight car-day (000) (M-240)	894	675	920	689
17	Per cent of home cars of total freight cars on the line (M-240)	34.40	51.90	34.50	51.40

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

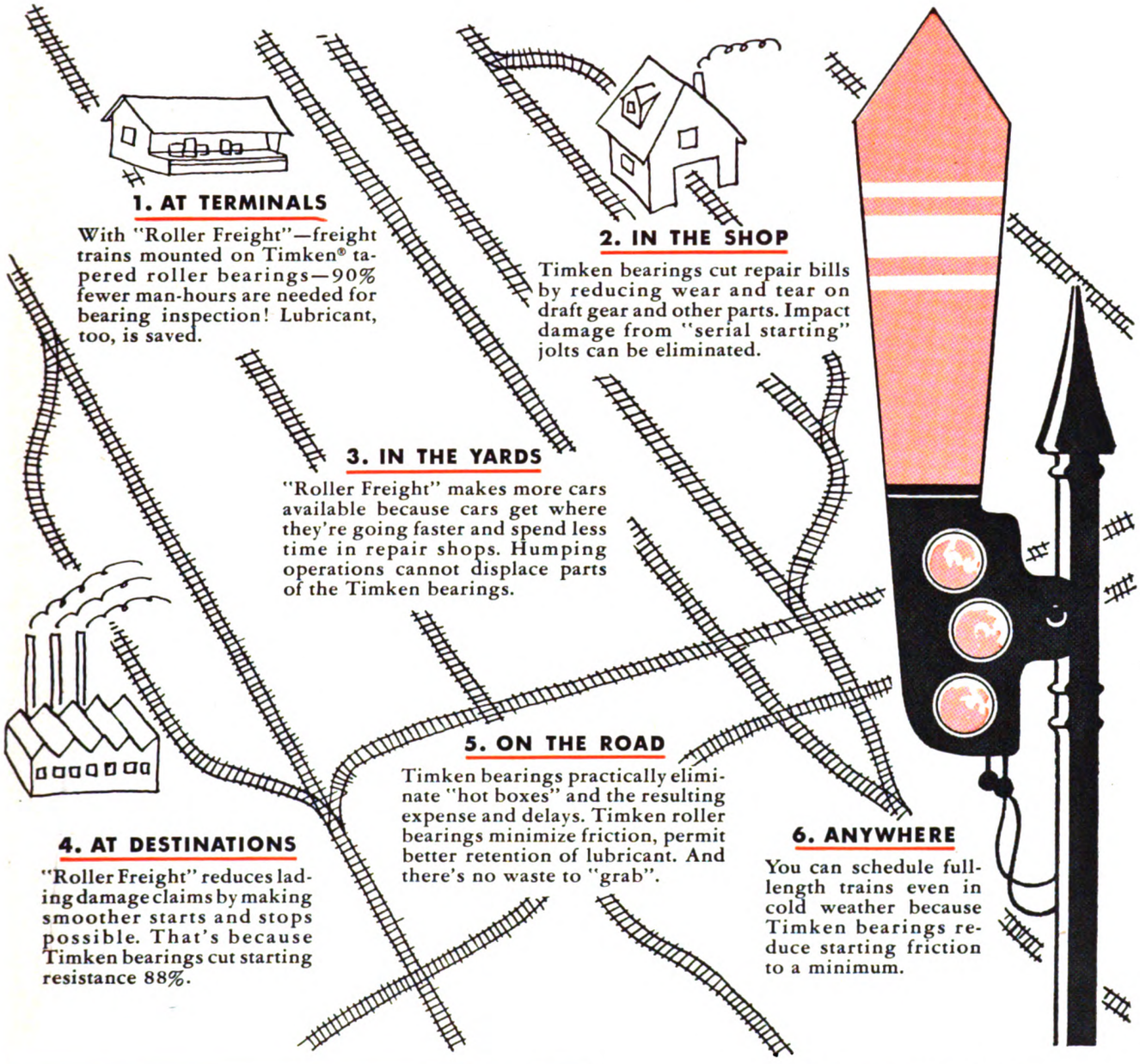
3	Road motive-power miles (000):				
3-05	Steam	10,221	8,956	22,805	21,332
3-06	Diesel-electric	14,009	12,987	30,011	27,108
3-07	Electric	1,429	1,446	3,144	3,108
3-04	Total	25,660	23,389	55,959	51,548
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	242,305	231,368	535,056	500,639
4-09	Total in coal-burning steam locomotive trains	53,625	43,097	121,351	104,900
4-10	Total in oil-burning steam locomotive trains	29,275	32,757	66,841	70,109
4-11	Total in Diesel-electric locomotive trains	144,582	139,574	313,792	291,548
12	Total car-miles per train-miles	9.33	9.57	9.46	9.45

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,238	1,187	2,683	2,610
1-02	Steam, oil-burning	218	209	477	436
1-03	Diesel-electric[1]	2,563	2,102	5,521	4,394
1-06	Total	4,042	3,522	8,734	7,489
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	48	57	106	127
2-02	Steam, oil-burning	12	12	27	26
2-03	Diesel-electric[1]	216	205	462	434
2-06	Total	306	305	660	653
3	Hours per yard locomotive-day:				
3-01	Steam	8.10	6.90	8.30	7.10
3-02	Diesel-electric	17.30	17.30	17.70	17.20
3-05	Serviceable	14.20	13.40	14.60	13.50
3-06	All locomotives (serviceable, unserviceable and stored)	12.30	10.90	12.60	11.00
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.85	1.93	1.85	1.96
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.78	0.82	0.77	0.81

[1] Excludes B and trailing A units.

"Roller Freight" clears the track for lower operating costs—*all along the line!*



1. AT TERMINALS

With "Roller Freight"—freight trains mounted on Timken® tapered roller bearings—90% fewer man-hours are needed for bearing inspection! Lubricant, too, is saved.

2. IN THE SHOP

Timken bearings cut repair bills by reducing wear and tear on draft gear and other parts. Impact damage from "serial starting" jolts can be eliminated.

3. IN THE YARDS

"Roller Freight" makes more cars available because cars get where they're going faster and spend less time in repair shops. Humping operations cannot displace parts of the Timken bearings.

4. AT DESTINATIONS

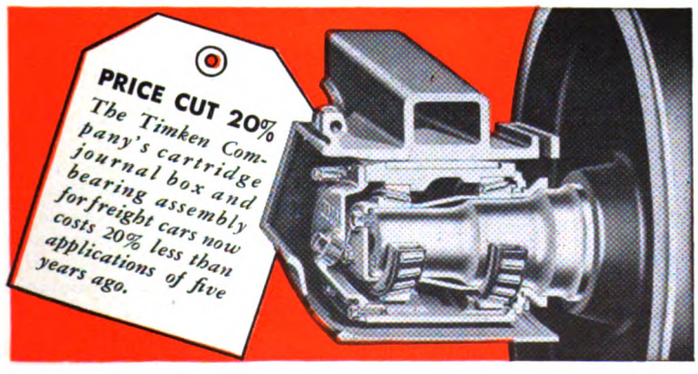
"Roller Freight" reduces lading damage claims by making smoother starts and stops possible. That's because Timken bearings cut starting resistance 88%.

5. ON THE ROAD

Timken bearings practically eliminate "hot boxes" and the resulting expense and delays. Timken roller bearings minimize friction, permit better retention of lubricant. And there's no waste to "grab".

6. ANYWHERE

You can schedule full-length trains even in cold weather because Timken bearings reduce starting friction to a minimum.



MORE BUSINESS, TOO!

Besides cutting operating costs, "Roller Freight" offers you another major advantage. It will give you a big, competitive talking point with shippers in your bid for a greater share of tomorrow's freight tonnage. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN TAPERED ROLLER BEARINGS

TRADE-MARK REG. U.S. PAT. OFF.

NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

Delivery of Used Rails, Axles Restricted by N.P.A.

ORDER M-64, effective May 28, was issued by the National Production Authority to restrict deliveries of used rails and railroad car and locomotive axles. According to an N.P.A. statement, the order was issued "to make available a larger number of used railroad rails and used axles from locomotives and freight and passenger cars for re-use or as scrap."

The statement summarized the order's "three major provisions" as follows:

1. After May 31, no person shall deliver or accept delivery of used rails or used axles of rerolling or scrap grade in an amount exceeding 10 tons of each item in any one month except by written authorization of N.P.A.

2. N.P.A. from time to time will allocate the supply of used rails and axles and specifically authorize quantities that may be delivered for particular uses.

3. Applications for authorizations must be filed with N.P.A. by the owners of materials. The application should state the quantity of used rails or used axles involved, the grade, contemplated party or parties to the transaction, and the location of the material.

Issuance of the order was "necessary," N.P.A. said, "because the rerolling rail mills, the rerolling axle industry, and the foundry and forging industries are increasing their demands for used rails and axles while inventories are dropping to a critical point."

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE JUNE ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Atlantic & Danville	1[1]	1,600	Road-switch	Alco-G. E.
Detroit, Toledo & Ironton	2[2]	1,500	Road-switch	Electro-Motive
Georgia	2	1,200	Switch	Electro-Motive
Pennsylvania	24	1,250	Passenger	Electro-Motive
	10	1,500	Switching	Electro-Motive
	54	1,500	Freight	Electro-Motive
	42	1,600	Freight	Baldwin-Lima-Hamilton
	20	1,200	Switching	Baldwin-Lima-Hamilton
	18	1,600	Freight	Alco-G. E.
	40	1,600	Switching	Alco-G. E.
	10	1,600	Switching	Fairbanks, Morse
Rutland	6[3]	1,000	Freight	Alco-G. E.
St. Louis-San Francisco	27[4]	1,500	Gen. purpose	Electro-Motive
	10[4]	1,200	Yard switch	Electro-Motive
St. Louis Southwestern	6'A'[5]	1,500	Freight	Electro-Motive
	6'B'[5]	1,500	Freight	Electro-Motive
	4	1,200	Switching	Electro-Motive
Spokane, Portland & Seattle	3[6]	1,200	Switching	Electro-Motive
	2[6]	1,600	Road switch	Alco-G. E.
Tennessee, Alabama & Georgia	3[7]	1,500	Road switch	Electro-Motive
Transportation Corps, U. S. Army	41	800	Switching	Electro-Motive

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type*	*Builder*
Burlington Refrigerator Express Co.	200[8]	50-ton refrigerator	Company shops
Chicago, Indianapolis & Louisville	1	Caboose	Thrall Car
Erie	2[9]	168-ton depressed center flat	Company shops
Grand Trunk Western	125[10]	70-ton covered hopper	American Car & Fdry.
Delaware & Hudson	500	50-ton box	Pullman-Standard
	500	50-ton hopper	Pullman-Standard
Illinois Central	50	Pulpwood	Company shops
	100	Caboose	Company shops
Missouri-Illinois	100[11]	70-ton covered hopper	Mo. Pac. shops
Norfolk & Western	100	70-ton covered hopper	Greenville Steel Car
Pittsburgh & West Virginia	5[12]	Caboose	Internat'l Ry. Car &]Equip.
St. Louis-San Francisco	200[13]	70-ton gondola	Pullman-Standard
St. Louis-Southwestern	75	50-ton box	General American
Southern Pacific	1,600	50-ton box	Pullman-Standard
	2,500	50-ton box	Company shops
	900	50-ton gondola	Company shops
Spokane, Portland & Seattle	500[14]	Box	Northern Pacific shops
Wabash	300[15]	50-ton box	Company shops

FREIGHT-CAR INQUIRIES

Spokane, Portland & Seattle	500	50-ton box
Tennessee Central	200	50-ton hopper
	150	70-ton hopper
Transportation Corps, U. S. Army	750[17]	100-ton flat
	250[17]	80-ton flat

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type*	*Builder*
Canadian National	58	Baggage	National Steel Car

[1] Delivery expected in July. Estimated cost, $150,000
[2] Delivery expected in October.
[3] Approximate cost, $675,000.
[4] Receipt of these units and of others currently on order but undelivered will permit complete dieselization, probably early in 1950, of the entire system, including the Alabama, Tennessee & Northern and the Quanah, Acme & Pacific.
[5] Eight of the freight units scheduled for delivery in November and four in December. Two switching units scheduled for November delivery and two for December delivery.
[6] For delivery in September and October.
[7] Approximate cost, $425,700. Two units have already been placed in service. The third is scheduled for delivery in July.
[8] For delivery during the first quarter of 1952.
[9] To be equipped with two four-wheel trucks at each end, with supporting span bolster, for transporting electric transformers.
[10] Approximate cost, $900,000.
[11] Delivery scheduled for September.
[12] Delivery tentatively scheduled for August. Approximate cost, $55,000.
[13] Delivery scheduled for the third quarter of 1952. Approximate cost, $1,275,000.
[14] Delivery expected to begin in September, 1952. Estimated cost, $3,000,000.
[15] For construction next year.
[16] Cost, $4,360,000. The cars will be 73½ ft. long, 10 ft. wide, and 13½ ft. high from the rail.
[17] One hundred of the 100-ton and 100 of the 80-ton cars for passenger service.

Chesapeake & Ohio.—The C&O's recent order for 107 diesel-electric locomotive units (June issue, page 92), was placed entirely with the Electro-Motive Division of General Motors Corporation. No portion of the order was placed with General Motors Diesel, Ltd.

Great Northern.—The Board of directors has authorized the purchase of 1,000 box, 700 ore, 300 ballast hopper, 50 express refrigerator cars, and 15 cabooses.

Northern Pacific.—The Northern Pacific will purchase 23 diesel-electric locomotive units for 1952 delivery. Included will be seven 1,200-hp. switching, four 1,500-hp. road-switching, one 1,500-hp. "B" freight and three 1,500-hp. passenger (two "A" and one "B") units, and two 4-unit 6,000-hp. freight locomotives.

Texas & Pacific.—The Texas & Pacific has authorized purchase of 20 diesel-electric locomotive units, including six 1,500-hp.

Union Tank Car Company.—This company's 1952 carbuilding program calls for construction of at least 600 50-ton tank cars (I.C.C. class 105-A-300-W) in its own shops. Cars of this type currently on order at the company's Whiting, Ind., and Philadelphia shops total 1,300, all scheduled for construction this year, contingent only upon receipt of necessary steel.

SUPPLY TRADE NOTES

GENERAL STEEL CASTINGS CORPORATION—*Harry E. Thiele* former vice-president—manufacturing of the General Steel Castings Corporation, has been elected vice-president with duties to be assigned by the president *Luther A. Kleber*, heretofore



H. E. Thiele

assistant vice-president — manufacturing, succeeds Mr. Thiele; and *J. Ellis Turner*, former manager of industrial relations, has been elected vice-president in charge of industrial relations.

◆

BULLARD COMPANY.—At a recent meeting of the board of directors of the Bullard Company *E. P. Bullard* resigned as chairman. The board unanimously voted to name him chairman emeritus. *E. P. Bullard III*, who has been vice-president in charge of manufacturing for the past 10 years, has resigned.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*S. C. Palmer*, formerly assistant manager

SPOT TROUBLE BEFORE IT HITS WITH HANDY G-E INSTRUMENTS

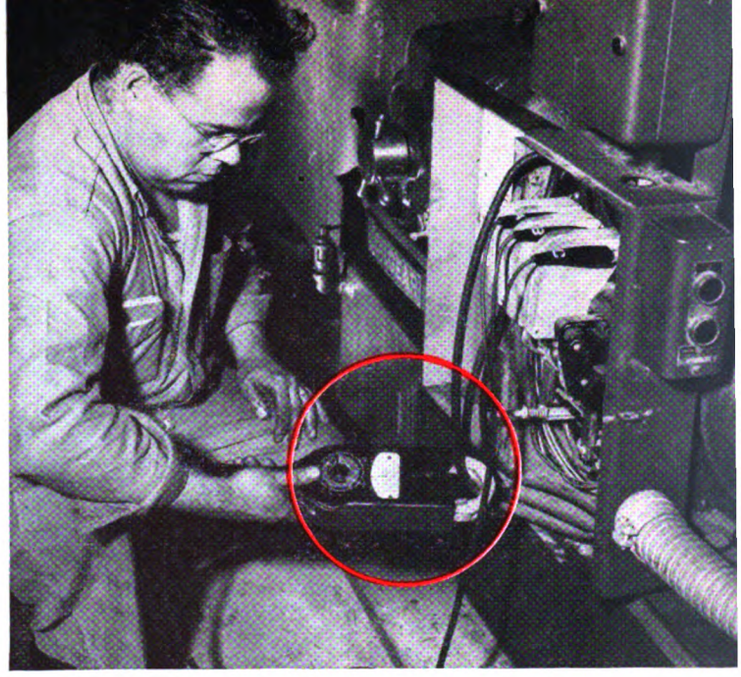
Road, signal, station, shop and other railroad electrical equipment can be tested simply and easily with General Electric instruments like these. Your G-E representative will be glad to show you how G-E test instruments can help cut costs by locating possible trouble sources. Call him today, or write to General Electric Company, Schenectady 5, N. Y.

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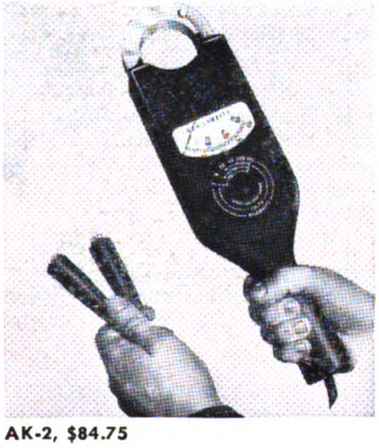


***New* Type AK-3 power-factor meter,** shown in use above with close-up at right, measures power factor directly without interrupting service. **Type AK-2 wattmeter, left, below,** being used to check a motor, with close-up next to it, measures a-c power quickly and easily—is ideal for trouble-shooting power surveys. **Type AK-1 volt-ammeter,** shown below, is used to make sure proper current is supplied to motors, transformers, etc.

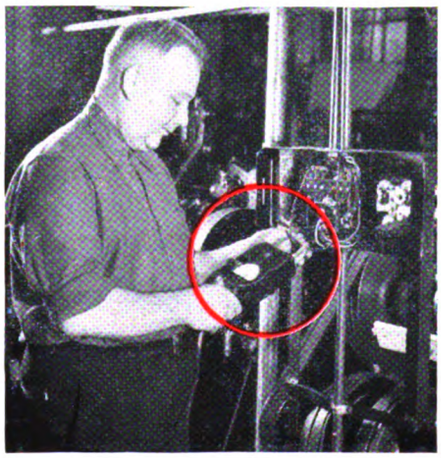


AK-3, $84.75





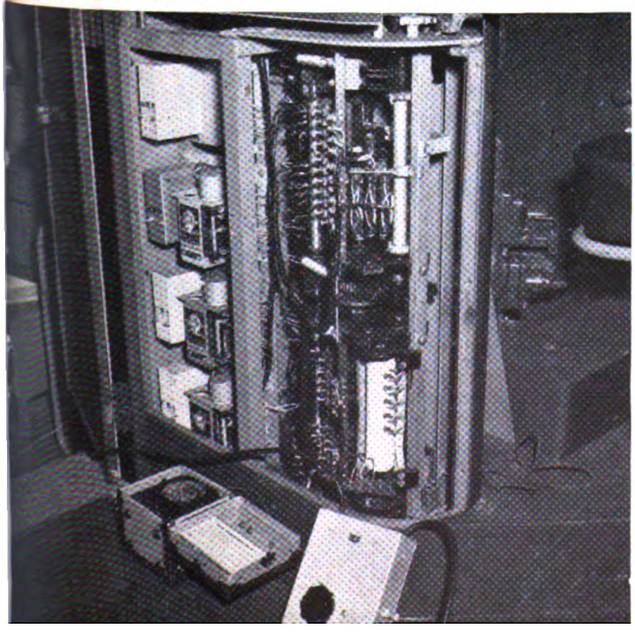
AK-2, $84.75



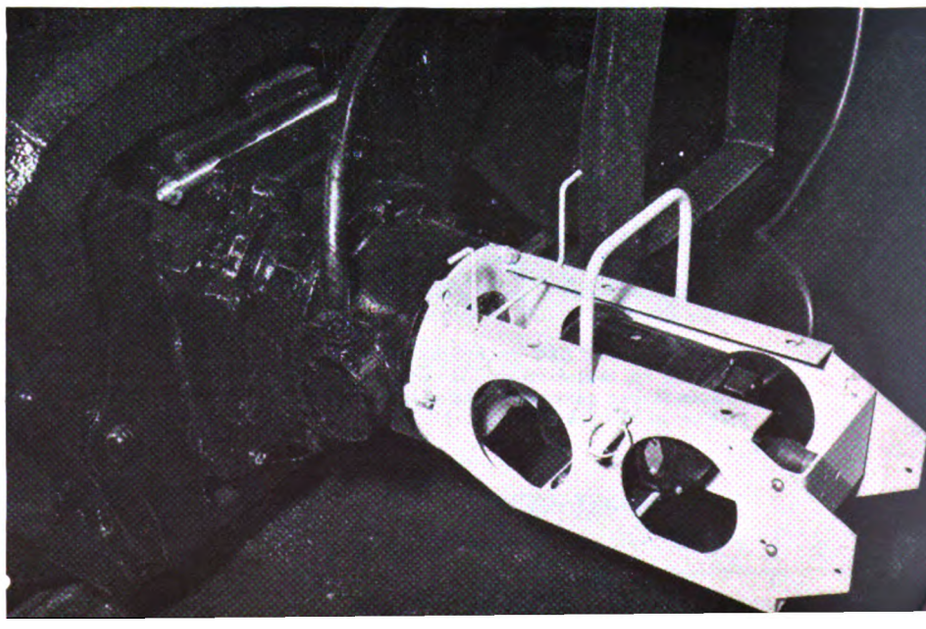


AK-1, $74.75

Speed-sensitive devices on Alco-GE road locomotives can be tested with equipment that consists of a ***new* portable axle-generator drive unit and a portable tachometer-frequency indicator.** The latter is shown below hooked up to the equipment to be tested, located in the cab.



Here is the axle-generator drive unit which, together with the tachometer-frequency indicator, is designed to speed up locomotive maintenance operations by aiding in the accurate setting of automatic-transition and over-speed relays, and checks the accuracy of speedometers and the sequence of contactors and speed-sensitive relays. The equipment can be operated by one man.



of the transportation sales department of the Westinghouse Electric Corporation, has been appointed manager of the department, succeeding *J. A. Schoch*, who has been appointed consulitng engineer for the transportation and generator division.

Mr. Palmer joined Westinghouse in 1931 as a member of the graduate student course and, in July, 1934, was assigned to sales duties in the Boston office. In 1946 he was appointed consulting engineer for the transportation division in the New England district and, earlier this year, was appointed assistant manager of the transportation department at East Pittsburgh.

◆

BUDD COMPANY.—*Henry F. Blankenbiller*, formerly in charge of railway disc brake sales for the Budd Company, has been appointed manager of the railway



Henry F. Blankenbiller

service department, to succeed *Clyde C. Elms*, who has retired. *Robert G. Stacy*, formerly assistant sales manager of the railway disc brake sales department, succeeds Mr. Blankenbiller as head of railway disc brake sales.

Mr. Blankenbiller joined Budd in 1940 in the automotive wheel sales department, at Detroit, and was placed in charge of railway disc brake sales in 1941.

Mr. Stacy joined Budd in 1936 and first worked in the blueprint department of the



Robert G. Stacy

product engineering division. He was one of a group who did research and development work on the disc brake. He was subsequently appointed assistant sales manager of the railway disc brake sales department.

◆

MORTON MANUFACTURING COMPANY.—*Robert S. Morton* has been appointed assistant sales manager of the railway division, Morton Manufacturing Company with headquarters at the company's general offices in Chicago.

◆

BINKS MANUFACTURING COMPANY.—The Binks Manufacturing Company has established a new office at 22-01 41st avenue, Long Island City 1, N. Y. *E. Cremer* has been appointed sales engineer and manager of the new office.

◆

DEARBORN CHEMICAL COMPANY—*L. C. Henley*, formerly car foreman on the Illinois Central, has joined the railroad department service staff of the Dearborn Chemical Company, replacing *J. W. Day*, who has been called to duty with the armed forces. Mr. Henley will service railroad cleaner accounts in the eastern division.

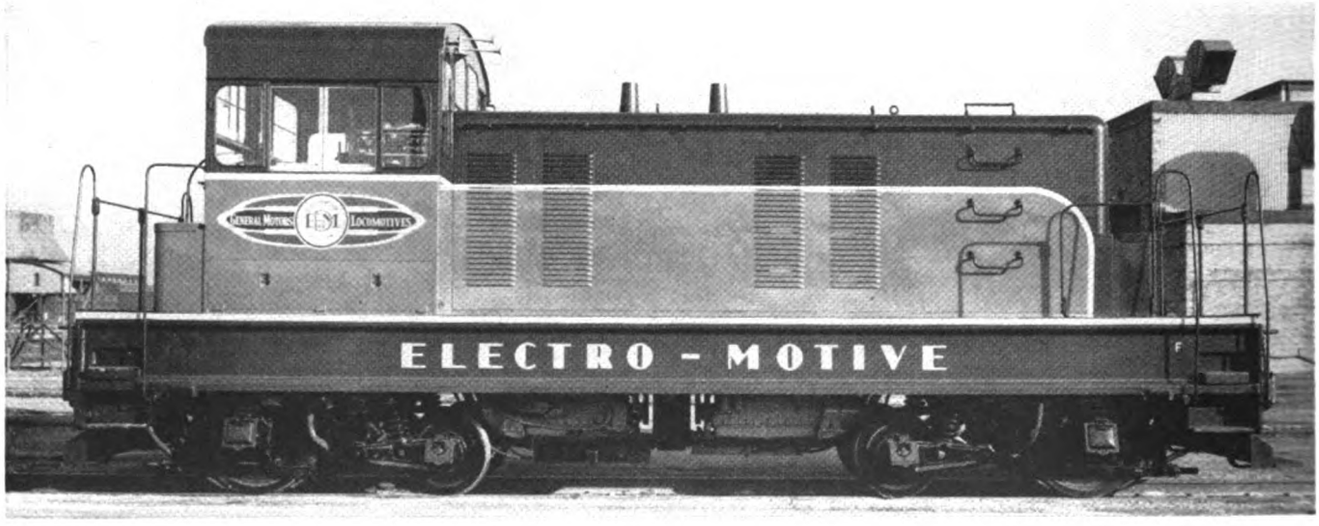
◆

AMERICAN LOCOMOTIVE COMPANY.—*John Thomas* has been appointed vice-president in charge of product engineering of the American Locomotive Company. Mr. Thomas, who has been with Alco for 22 years,

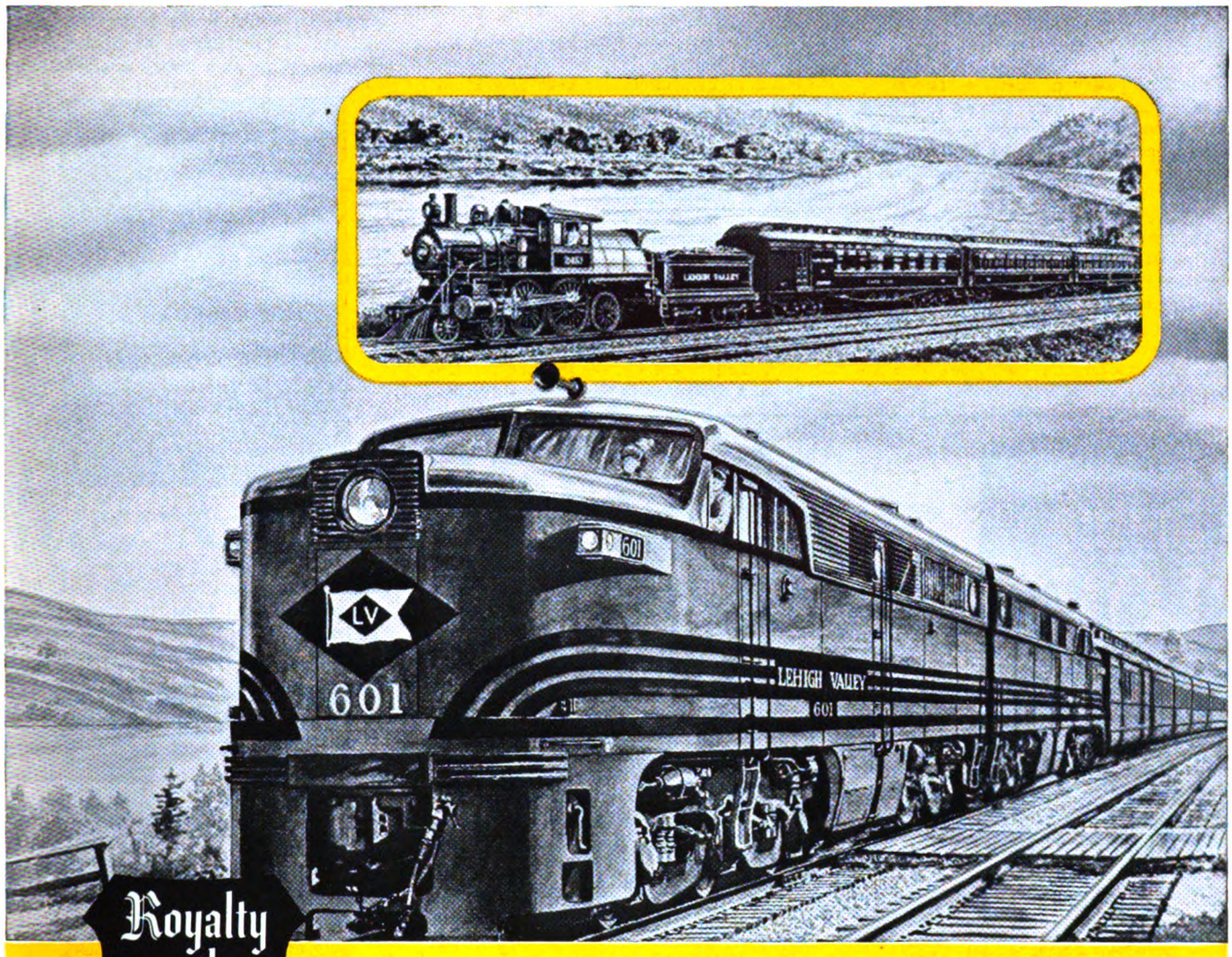


John Thomas

has been manager of the locomotive division of American Locomotive, with headquarters at Schenectady, N. Y., since 1948.



An experimental 340-hp. hydraulic switching locomotive built by the Electro-Motive Division of General Motors. The locomotive, intended for industrial use, is not yet ready for production. It is powered by two G. M. model 6-71 diesel engines equipped with Allison torque converter transmissions. It was announced for the first time on June 14 at ceremonies commemorating the completion of the 10,000th G. M. diesel locomotive unit.



Royalty on the Rails

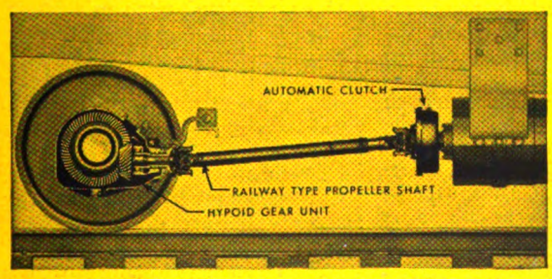
The Lehigh Valley "Black Diamond Express"

Spicer Generator-Drive Equipped

On May 18, 1896, The Black Diamond Express made its first run between the sea and the Great Lakes. People liked this new train, the beautiful scenery through which it ran, the dining service equal to that of first class hotels, and the courteous and efficient train crew.

Now in its fifty-third year, The Black Diamond still makes its daily run between New York City and Buffalo, but what changes in equipment and facilities have occurred during its history! Equipped with new Diesel locomotives, air-conditioned coaches and parlor car, including a glass-enclosed observation lounge car, and a dining service still one of the finest on any railroad, this famous train continues to offer travelers the utmost in comfort and luxury. The heavy demands for electrical current are met amply by the efficiency of Spicer Railway Generator Drives.

An imposing list of America's crack trains and streamliners rely upon Spicer equipment for electrical service of the highest efficiency. Write for literature giving complete details of the Spicer Railway Generator Drive.



The Spicer Railway Generator Drive is easily adaptable to old and new equipment

47 YEARS OF **Spicer** SERVICE

The Spicer Railway Generator Drive is manufactured, sold and serviced by

SPICER MANUFACTURING
Division of Dana Corporation
TOLEDO 1, OHIO

Prior to that, he was manager of the company's Auburn, N. Y., plant.

◆

JOHN N. THORP COMPANY.— The offices of the John N. Thorp Company, distributors of railway and marine supplies, have been moved from 50 Church street, New York, to 78 Middagh street, Brooklyn 2, N. Y.

◆

TEXAS COMPANY.—*J. G. Wallace*, formerly division manager for the Texas Company at San Francisco, has been appointed assistant manager, railway traffic and sales department with headquarters at New York. *Walter E. Wilcox*, formerly assistant division manager at St. Louis, has been appointed division manager, railway sales division, at San Francisco.

Mr. Wallace joined the company as lubricating engineer in 1924 and was advanced to division manager at San Francisco in April, 1933.

Mr. Wilcox joined Texas in November, 1933, as lubrication engineer, and was appointed assistant division manager at St. Louis in February, 1945.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*John C. Wallace* has been appointed chief engineer for the newly created diesel locomotive parts research and development division of the Hunt-Spiller Manufacturing Corporation, Boston, Mass.

Mr. Wallace entered the railroad field in 1946 as a draftsman in the equipment maintenance department of the Bessemer & Lake Erie, and in 1948 joined the Lima-Hamilton Corporation as a design engineer. He



J. C. Wallace

was engaged in diesel locomotive application surveys before his appointment as engineering representative in 1950 and, following the Baldwin, Lima-Hamilton merger, was transferred to Eddystone, Pa., as special projects development engineer.



F. I. Fickett

Franklin I. Fickett has been appointed railroad sales engineer in Indiana, Ohio and Michigan for the Hunt-Spiller Manufacturing Corporation, Boston. Mr. Fickett was formerly with Fairbanks, Morse & Co.

◆

KOPPERS COMPANY.—*Walter P. Arnold*, executive assistant to H. R. Condon, vice-president and general manager of the wood preserving division of the Koppers Company, and *Frank H. Fischer*, assistant general manager of the division, in charge of activities in eastern United States, have been appointed vice-presidents in the division.

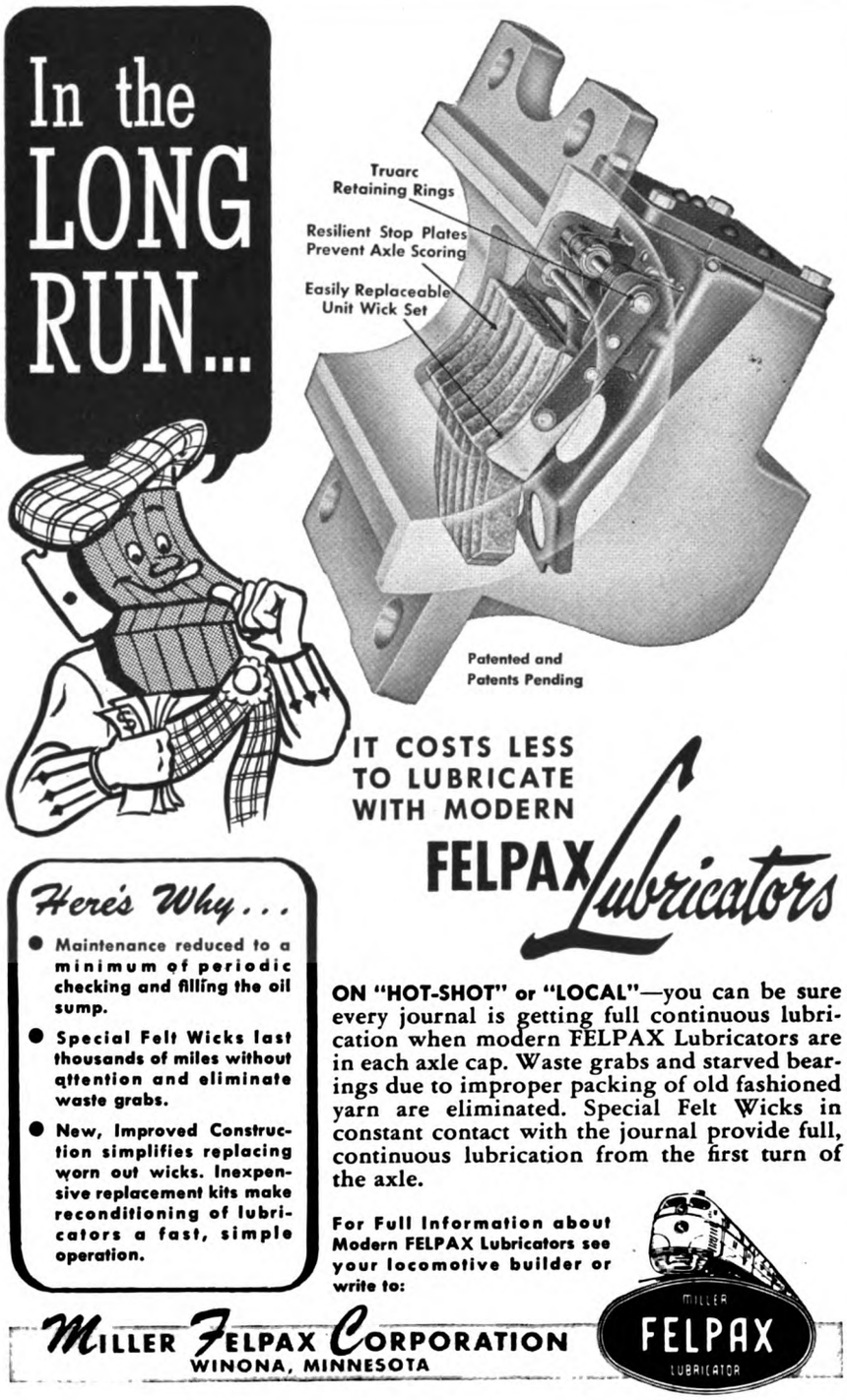
◆

FAIRBANKS, MORSE & CO.—*Charles A. Mapp* has been appointed district manager of locomotive sales in the Chicago area for Fairbanks, Morse & Co.

◆

WESTINGHOUSE AIR BRAKE COMPANY.— The Westinghouse Air Brake Company has established sales facilities in Canada for its air compressors and pneumatic control equipment. The *Canadian Westinghouse Company*, Hamilton, Ont., will handle the

(*Continued on page 102*)



the mountain the Clinchfield

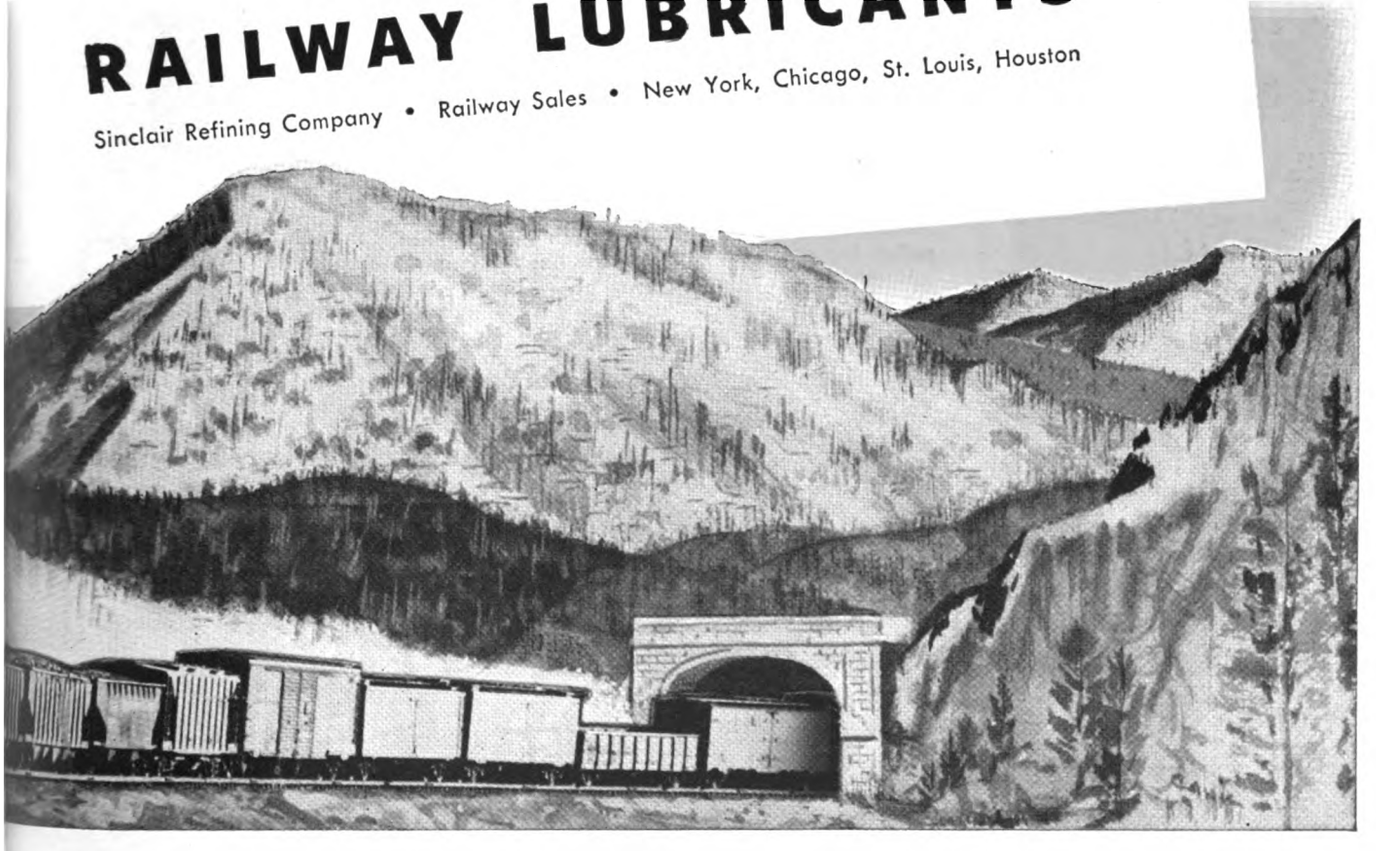
handles huge coal tonnages and fast, Florida perishable freight.

Despite difficult road conditions, the Clinchfield maintains fast, on-time schedules with powerful Diesels, which are lubricated with Sinclair GASCON® Oils.

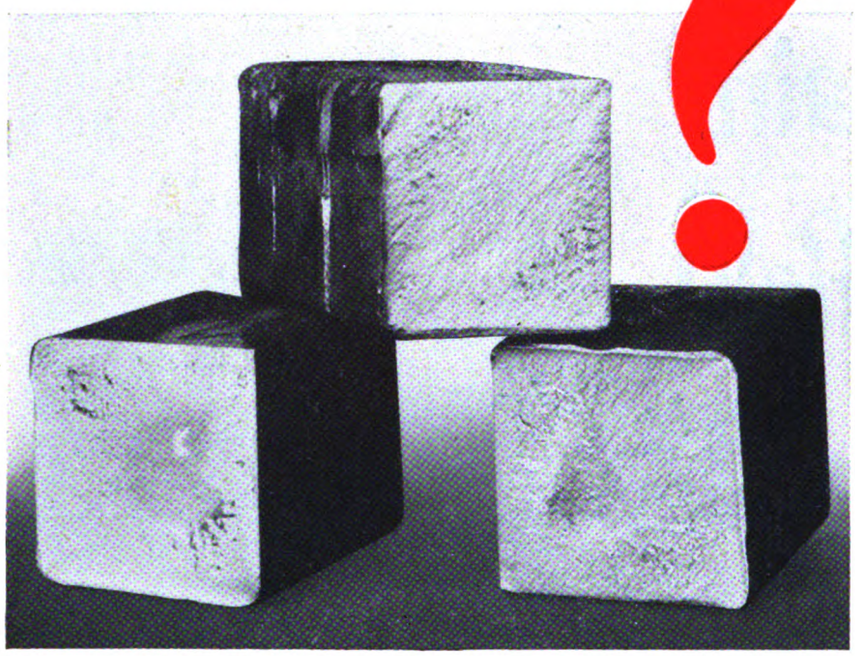
America's top railroads have discovered that, when road, weather, or hauling conditions are tough, Sinclair GASCON Oils keep Diesels running cleanly, smoothly, and dependably. Are you taking advantage of these fine lubricating oils for *your* Diesels?

SINCLAIR RAILWAY LUBRICANTS

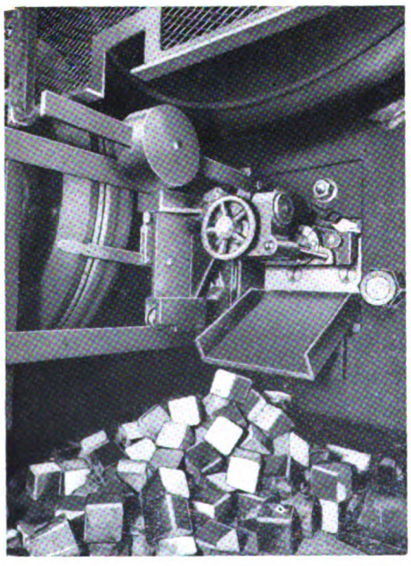
Sinclair Refining Company • Railway Sales • New York, Chicago, St. Louis, Houston



DO YOU KNOW THE ADVANTAGES OF SHEARING BILLETS OVER NICKING AND BREAKING?



- High cutting speeds
- Clean, square cuts
- Uniform, sheared pieces



alloy steel billet cut by a "Buffalo" Billet Shear, showing the clean, square cuts produced. There is no "smearing" of the metal, or "notches" on one edge, as in nicking and breaking. "Pipes" in the billet could be easily detected. Sheared pieces are kept to uniform weight, and there is no expense for gas and burner. Best of all, these pieces are cut at the rate of *10 per minute!* "Buffalo" Billet Shears are built in sizes to handle up to 10-inch rounds and 9-inch squares. HUNDREDS are in use! WRITE FOR BULLETIN 3295-A, for facts on lower cost shearing of billets.

BUFFALO FORGE COMPANY

174 Mortimer St. Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

(Continued from page 98)

Westinghouse line of industrial air compressors and pneumatic controls for oil rigs, marine vessels and general industrial applications. Complete coverage for sales and service will be provided through district offices in Halifax, N. S.; Moncton, N. B.; Montreal, Que.; Toronto, Swastika and Ft. William, Ont.; Winnipeg, Man.; Regina, Sask.; Edmonton and Calgary, Alta.; and Vancouver, B. C.

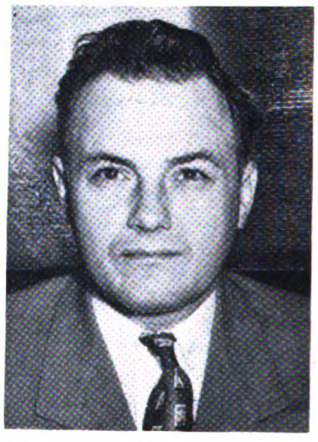
◆

PERCY H. WALLER has opened offices at 122 South Michigan avenue, Chicago, and will represent the American Manganese Steel division of *American Brake Shoe Company*, offering railroads and carbuilders a new line of specially designed railway truck, brake and running gear specialties known under the trade name Mangosteel.

Mr. Waller was formerly associated with the Pullman Company for 37 years in various divisions, more recently as assistant chief engineer and assistant to the chief maintenance officer.

◆

BENDIX AVIATION CORPORATION.—*Leonard O. Mjolsnes*, assistant chief engineer of the diesel equipment section of the *Scintilla Magneto division* of Bendix Aviation



Leonard O. Mjolsnes

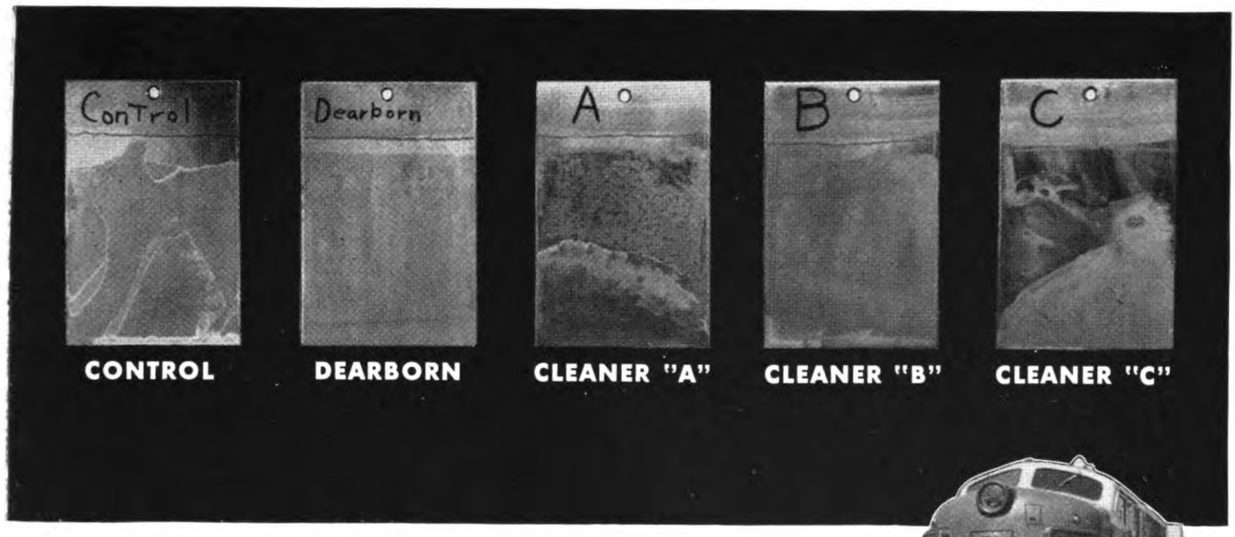
Corporation, Sidney, N. Y., has been appointed chief engineer of the section, succeeding *A. T. Bremser*, deceased.

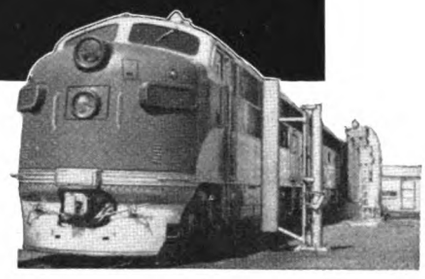
Mr. Mjolsnes, a graduate of the University of Minnesota in 1935 with a B. S. degree in mechanical engineering, worked for the Baldwin Locomotive Works at Philadelphia, and for the Detroit Diesel Engine division of General Motors Corporation before he joined Scintilla in July, 1947.

◆

KEARNEY & TRECKER CORP.—*Ralph W. Burk*, vice president of sales for the Kearney & Trecker Corp. since 1943, has been elected vice president for manufacturing. Mr. Burk will continue also as head of the company's sales division.

Mr. Burk joined Kearney & Trecker in 1927 after 10 years with a Philadelphia dealer for the company. He also served as Detroit branch office manager, assistant division sales manager, and general sales manager prior to his election in 1943 to the sales vice-presidency. Mr. Burk is a director of Amtea Corporation, an affiliate





COMPETITIVE TESTS

demonstrate the non-streaking, sheen-producing properties of Dearborn railroad cleaners

These unretouched laboratory test panels conclusively demonstrate the superiority of Dearborn cleaners. A Dearborn Engineer will produce similar results with your equipment . . . and at savings in cleaner cost and man-hours that will be a pleasant surprise.

■ EXTERIOR CLEANERS
Specialized products containing non-streaking and sheen-producing agents formulated to keep painted and lacquered surfaces and polished metal surfaces sparkling new.

■ INTERIOR CLEANERS
Detergent and solvent type materials for interior cleaning of Diesel locomotives, passenger and baggage cars, roundhouses, offices. Designed for safety and economy.

■ ORGANIC SOLVENT TYPE CLEANERS
Compounded for cold cleaning of Diesel parts and filters at terminals lacking heating facilities. Also recommended for cleaning Diesel trucks, Diesel locomotive interiors, traction motor gears, steam locomotive running gear and other parts where excessive oil and grease are present.

■ HOT TANK CLEANERS
For use on steam locomotive side rods, wheels and other parts that become heavily coated with grease and dirt. Also long life materials for cleaning air filters, oil and sintered bronze filters and specialized formulas for non-ferrous metals.

■ ELECTRICAL PARTS CLEANERS
A special solvent of low toxicity for spray cleaning of electrical cabinet interiors, relays, motor windings, other electrical equipment. Removes tarnish and oily film. Will not harm insulation.

■ SCALE REMOVER CLEANERS
For removing scale from Diesel cooling systems with acid pump. While this formula is designed for removing scale from ferrous metals, it may be safely used for cleaning units constructed of copper, bronze, brass or the alloys of these metals.

✓ CORROSION-FREE
Clean with safety. Dearborn cleaners remove surface grime and dirt films without danger of subsequent corrosion.

✓ ECONOMICAL
Lower cleaner cost plus increased coverage per pound results in substantial, traceable savings. Ask for comparative facts.

✓ EASY TO SELECT
The Dearborn line of cleaners has been streamlined to reduce time devoted to ordering, conserve space needed for stocking.

✓ EASY TO USE
Fewer man-hours are needed to clean equipment with Dearborn free-rinsing railroad cleaners.

WRITE. A Dearborn Engineer is ready to discuss your cleaning requirements. Write for complete information on how to "Clean with SAFETY" with the complete, versatile line of Dearborn Railroad Cleaners.

Please note our new address
DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza • Chicago 54, Illinois

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. RM
Chicago 54, Ill.

☐ Send complete information on Dearborn Cleaners

☐ Have a Dearborn Engineer call

Name.....

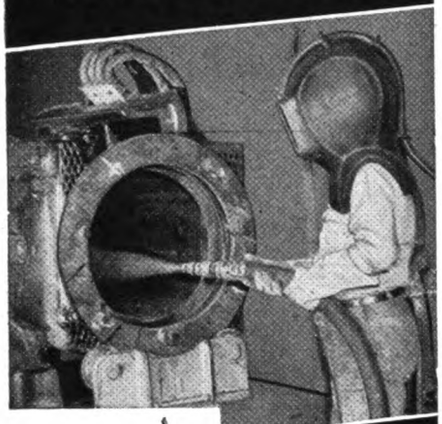
Railroad.....

Address.....

City ..... *State*.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

CLEAN
Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER
with the right equipment for every job

for sales of Kearney & Trecker machine tools in South America, and has served on several committees of the National Machine Tool Builders' Association since 1943.

◆

GUSTIN-BACON MANUFACTURING COMPANY.—*E. N. Sleight* has been elected vice-president in charge of the Chicago office.



E. N. Sleight

Mr. Sleight joined the company in 1937 in Kansas City as a sales trainee in the railroad sales department. He was transferred to the Chicago office in September, 1937, and was appointed division manager in January, 1943. As vice-president, Mr. Sleight will continue sales management of the Chicago office.

WATSON-STILLMAN COMPANY.—*Albert B. Diss*, assistant to the executive vice-president of the Watson-Stillman Company since he joined the firm in November 1950, has been appointed manager of manufacturing operations, and will head all activities in the manufacturing, production, purchasing and sub-contracting departments.

◆

GRAYBAR ELECTRIC COMPANY.—The Graybar Electric Company has a new Eastern district headquarters in a three-story, block square building, located at Bridge Plaza North and 21st street, Long Island City, N. Y. The move was from 180 Varick street, New York.

◆

GENERAL ELECTRIC COMPANY.—*Philip H. Hatch* has become associated with the Transportation Divisions of the General Electric Company at Schenectady, N. Y. A picture and a sketch of Mr. Hatch's career appeared on page 114 of the June issue at the time of his retirement as general mechanical superintendent of the New York, New Haven & Hartford.

◆

IRON & STEEL PRODUCTS, INC. Chicago, has announced the following appointments: *James J. Collins*, general manager of Iron & Steel Products, Inc., has been appointed vice-president and general manager; *Edward J. Sagert*, assistant to executive vice-president, has been appointed vice-presi-

IDEAL

For Faster, Smoother Tube Rolling

IDEAL MASTER Tube Expanders

designed to withstand severe strains of power production —for the manufacture and repair of LOCOMOTIVE and other FIRE TUBE BOILERS.

No. 54-S . . . for rolling tubes in the FIRE BOX end. Has rolls 1¼" long. Expander will automatically draw tubes out against guard uniformly ¼" for beading.

No. 54-L . . . for rolling tubes in the SMOKE BOX END . . . has rolls 1⅞" long, for heavy sheets and where tubes project various distances beyond sheet.

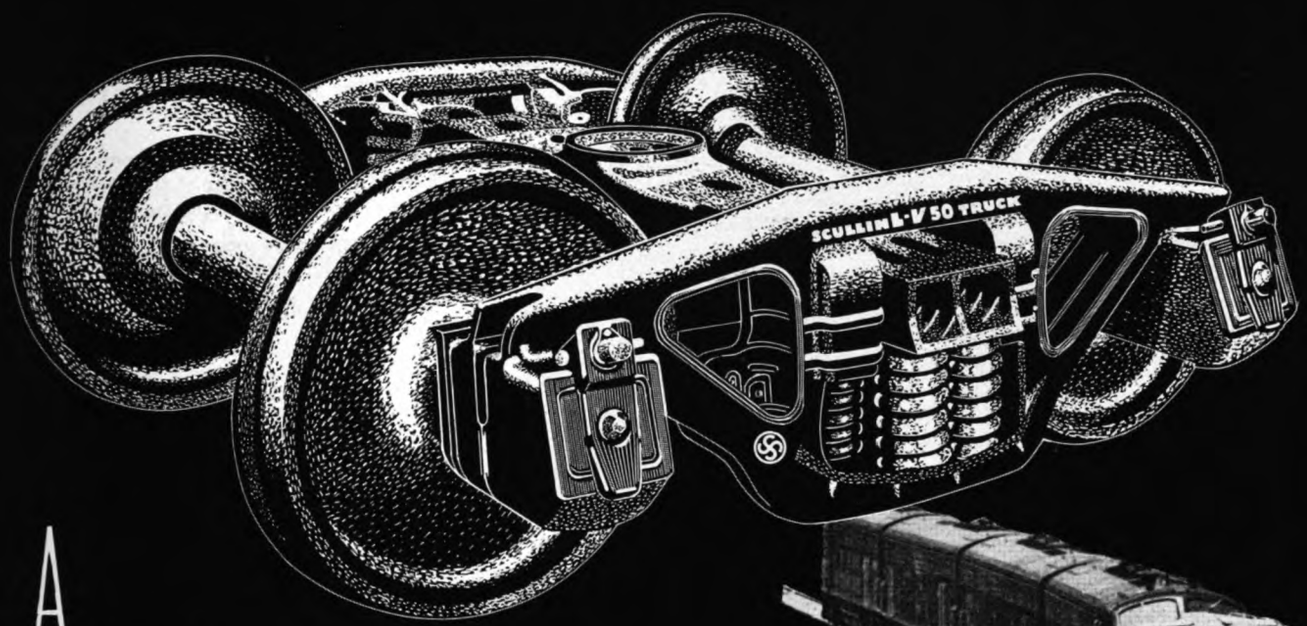
Similar Ideal Tube Expander (No. 60) made for rolling and flaring tubes in one operation.



No. 54

See Your Dealer, or Write Us Today!

THE GUSTAV **WIEDEKE** COMPANY
DAYTON 1, OHIO



Any freight car is a more profitable car on

SCULLIN L 50 V TRUCKS
LATERAL VERTICAL
CUSHIONED MOTION

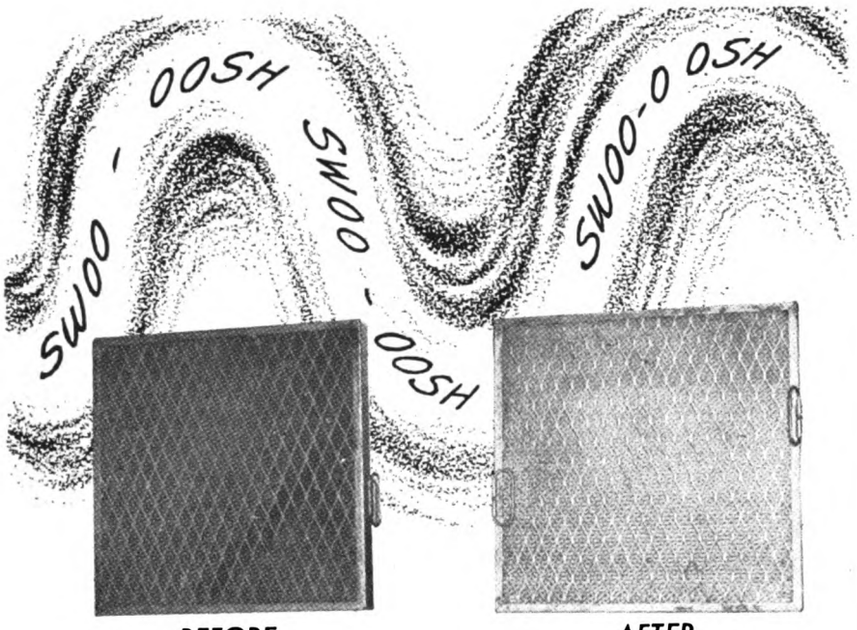
THE SMOOTHEST TRAFFIC-BUILDERS BETWEEN LCL AND YOUR RAILS

STEEL CASTINGS MANUFACTURER

NEW YORK
CHICAGO
BALTIMORE
RICHMOND, VA.

SCULLIN STEEL CO.

SAINT LOUIS 10, MISSOURI



BEFORE AFTER

Clean and Oil Your Air Filters with the Part Time of One Unskilled Workman!

When you use the Magnus Filter Cleaning and Oiling Method, you handle filters in batches. 18 large filters (20"x 22"x 2¼") or 36 small filters (9"x 20"x 2¼") are "swooshed" clean at one time by the vigorous action of the cleaning solution through all areas of the filters, as they are moved up and down 54 times a minute in the Magnus Aja-Dip Cleaning Machine. It takes about 2 minutes to clean out all dirt and clogging deposits.

It takes just one minute to water-rinse each batch in a Magnus Aja-Dip Rinsing Machine. A one-minute dip in a Magnus Hot Oil Tank, followed by final drying in a Magnus Dryer, gives you a batch of cleaned, oiled filters . . . ready for use.

With these five processing machines, your entire filter cleaning, oiling and drying operation can be carried on by one unskilled worker in only a part of his time. At the same time you get much better cleaned filters, more uniformly oiled, than you can possibly get with sprays, steam guns or geyser type equipment.

If you want to cut your filter cleaning and oiling costs— ask for complete information on the Magnus Method.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

dent; *William J. Parker II*, superintendent, has been appointed general superintendent; and *Warren C. Stevens*, general foreman, has been appointed superintendent.

◆

EX-CELL-O CORPORATION.—*Donald H. McIver* has been elected vice-president in charge of industrial sales.

◆

VAPOR HEATING CORPORATION.—*G. C. Scott*, service manager of the Vapor Heating Corporation, has been appointed service



G. C. Scott



R. J. Armbrust

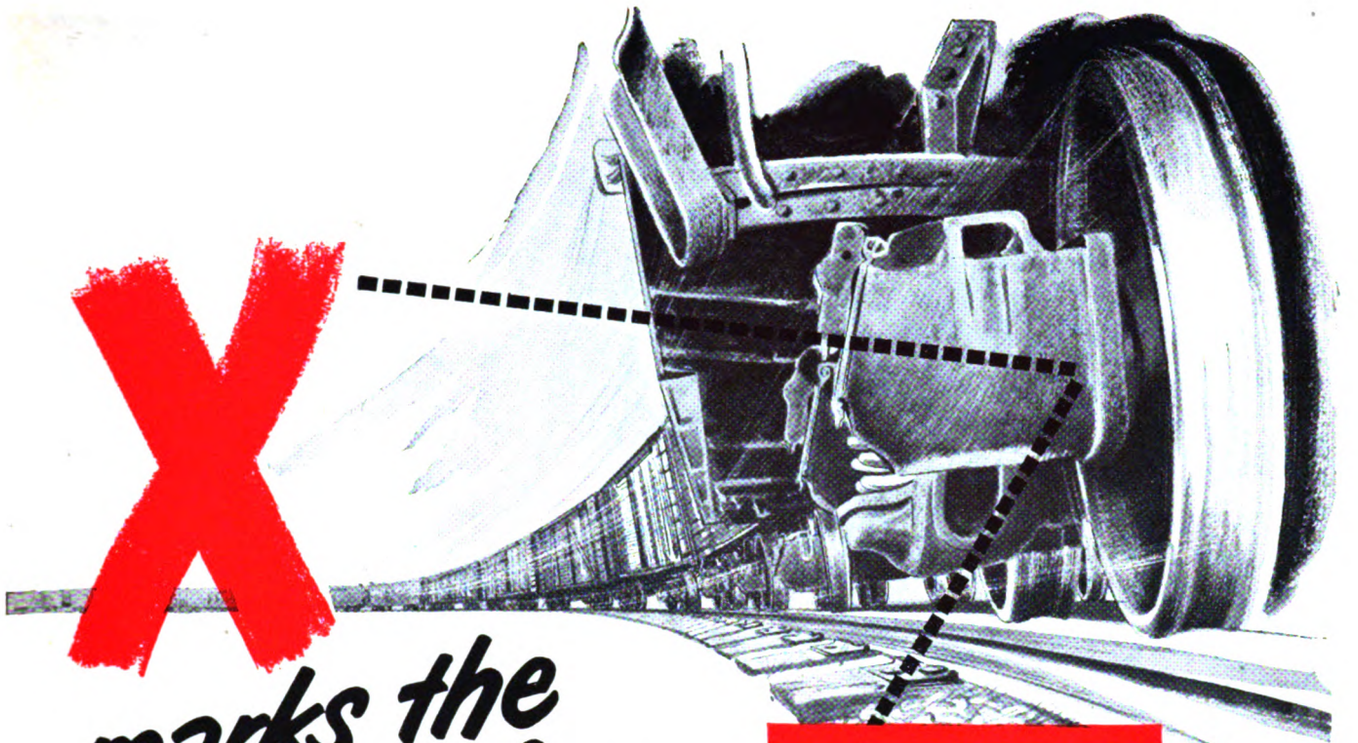
assistant to the vice-president in charge of sales, and *R. J. Armbrust* succeeds Mr. Scott as service manager. Mr. Armbrust has been associated with Vapor in a service capacity for nine years.

◆

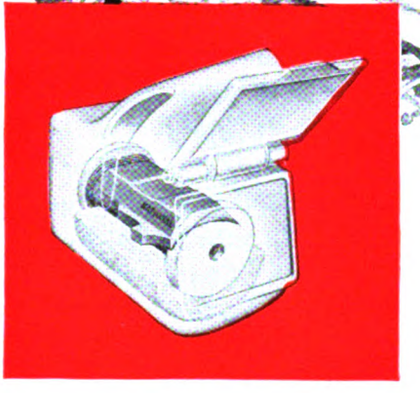
BUDA COMPANY—*Carl G. Meyer*, who has been appointed district representative for the Buda Company, handling sales of Buda fork lift trucks, industrial tractors, "Chore Boys," and lifting jacks to distributors and railroads in southeastern territory, with headquarters at 110 Maple street, Decatur, Ga. Mr. Meyer formerly was with the sales department of the Towmotor Corporation.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*Mark M. Miller*, formerly assistant sales manager of the Indianapolis, Ind., plant of the National Malleable & Steel Castings Co., has been appointed sales manager of the plant and *John H. Murphy*, formerly a member of the sales department,



X marks the source of a smoother ride



Flexible Control of lateral shocks — another reason why railroads standardize on SOLID JOURNAL BEARINGS

A smooth ride requires control of *lateral* shocks and vibration, as well as *vertical.* That's why nothing equals the smooth ride of the standard truck equipped with A.A.R. Solid Journal Bearings. The Solid Bearing has "built-in flexibility" in the form of lateral clearance . . . normal lateral shocks and vibration are cushioned instead of being rigidly opposed, being contained in the wheel and axle instead of transmitted through the car to the lading. This flexibility is accomplished *without expensive, complicated designs that hamper free interchange of cars.*

The efficient, simple design of the Solid Journal Bearing has made unmatched records of dependable service—*and low cost service.* As a result, they're standard equipment on America's Freight Cars.

More Service-Proved FACTS about Solid Journal Bearings

Unmatched Performance — with as high as 6½ Million bearing miles per car setout.

Easiest to Maintain — replacement takes minutes, without need for skilled labor.

Simple in Design—the only answer to unrestricted interchange.

Lowest Cost—save over 25% on car cost; average only $20.00 per car set in replacement.

Most Liberal Tolerances — axles can be used and re-used with simple roller burnishing.

Lowest Running Friction—a single film of oil permits faster acceleration, lower running resistance — particularly at low temperatures.

Lightest Weight—up to 60% less dead weight than any other type of bearing.

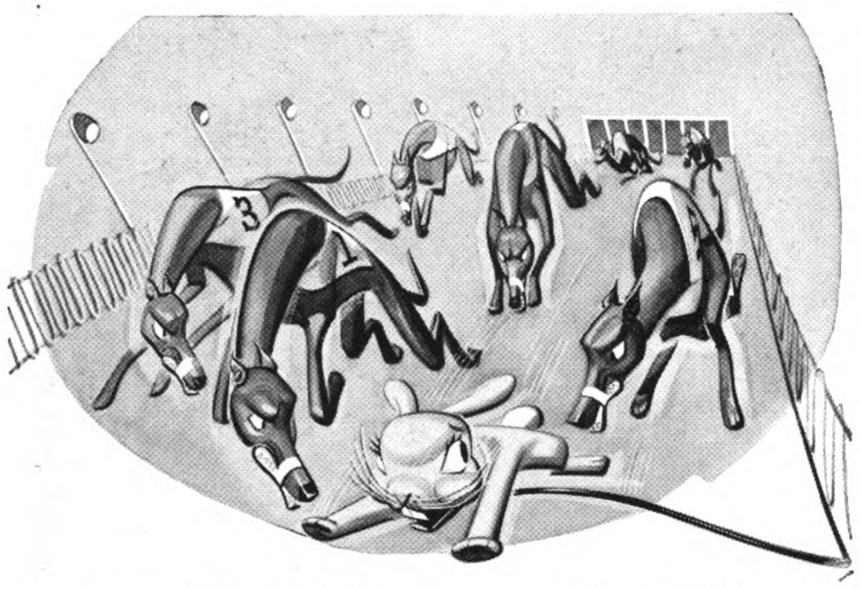
National Bearing Division—Serving America's Railroads Since 1874

AMERICAN Brake Shoe COMPANY

NATIONAL BEARING DIVISION

4938 Manchester Avenue • St. Louis 10, Mo.

PLANTS IN: ST. LOUIS, MO. • MEADVILLE, PA. • NILES, OHIO • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.



Saved... By a Dow Corning Silicone

The pelt of many a mechanical rabbit has been saved by rewinding the motors that drive them with Dow Corning Silicone (Class H) electrical insulation. That's a modern Aesop's fable* uncovered by our Atlanta office.

Here's the moral. When your private or corporate life depends upon continuous operation, specify Dow Corning Silicone insulated motors, generators, transformers or solenoids. The more it costs you to permit a motor to fail, the more imperative it is to prolong the life and to increase the reliability of that motor with Class H insulation made with Dow Corning Silicones.

For about twice the cost, you get ten times the life; for a few hundred dollars, you save several thousand dollars in lost production, man hours of labor, maintenance costs and repair bills.

Write today for more information on how you can keep ahead of the pack with Dow Corning Silicone (Class H) Insulation.

*** This fable can be and has been acted upon to save the less expendable hides of some of the most able electrical maintenance engineers.**

MAIL THIS COUPON TODAY

DOW CORNING CORPORATION, MIDLAND, MICHIGAN
Please send me more information including list of Class H motor shops and Class H motor manufacturers. S-7

Name_____ Title_____
Company_____
Street_____
City_____ Zone____ State____

FIRST IN SILICONES
DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS • LOS ANGELES • NEW YORK
WASHINGTON, D. C. • In CANADA: Fiberglas Canada Ltd., Toronto • In GREAT BRITAIN: Midland Silicones Ltd., London.

has been appointed assistant sales manager. Mr. Miller is succeeding *A. L. McColloum*, who is retiring after more than 30 years of service with the company.

The National Malleable & Steel Castings Co. is beginning a $6,300,000 expansion program which will increase its capacity by about 25 per cent, according to Cleve H. Pomeroy, president. All plants at Cleveland, Chicago, Indianapolis, Sharon, Pa., and Melrose Park, Ill., will share in the improvements. The largest expenditures are planned for the Cleveland works, where an entire new malleable foundry unit will be added. Some equipment will be in operation by mid-year and all improvements should be completed by a year from now.

◆

TIMKEN ROLLER BEARING COMPANY.—*William E. Mott* has been appointed a sales engineer, Railway Division, at the New York office of the Timken Roller Bearing Company.

◆

JOSEPH DIXON CRUCIBLE COMPANY—*Anthony J. Nino, Jr., has* been appointed domestic general sales manager of the Joseph Dixon Crucible Company, with headquarters at Jersey City, N. J. Mr. Zino formerly was assistant to president of Swan-Finch Oil Corporation.

◆

FARR COMPANY.—The Farr Company has moved its main office and production facilities to 2301 East Rosecrans avenue, El Segundo, Cal.; mailing address is P. O. Box 10187, Airport Station, Los Angeles 45. The company's Chicago branch office and warehouse also has moved to larger quarters at 5433 West Belmont avenue.

◆

WILLSON PRODUCTS, INC.—*Thomas A. Willson*, has been elected a vice-president of Willson Products, Inc., Reading, Pa. Mr. Willson will continue also as assistant secretary.

◆

NATIONAL PNEUMATIC COMPANY.—The National-Pneumatic Company has opened an office at 1228 Buhl building Detroit. *T. Austin Casey*, formerly of the Chicago office, has been appointed to take charge of the new Detroit office.

◆

UNION CARBIDE & CARBON CORP.—*Kenneth I. Thompson*, general sales manager of the Oxweld Railroad Service Company, a division of Union Carbide & Carbon Corp., at Chicago, has been elected also a vice-president and director of the Canadian Railroad Service Company, a unit of Union Carbide & Carbon.

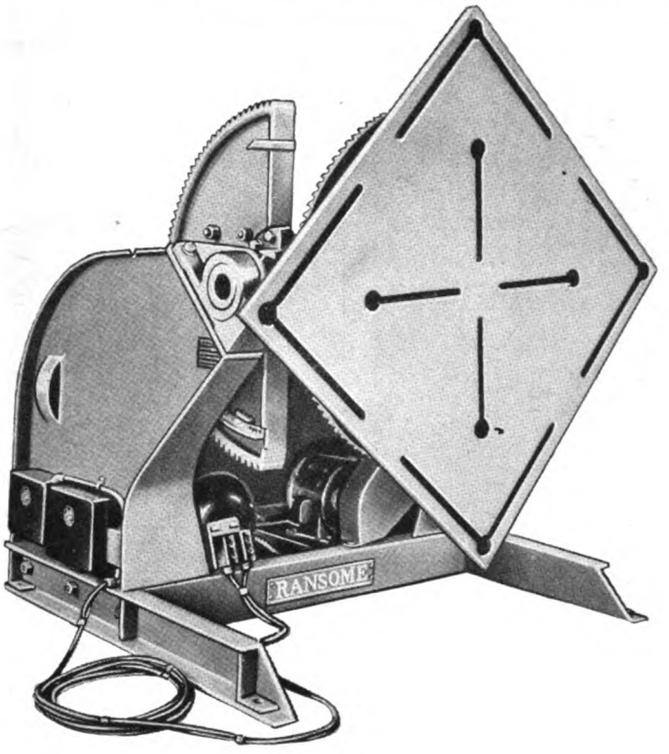
J. V. Condon has been appointed general manager of the *Canadian Railroad Service Company*, a unit of the Union Carbide & Carbon Corp., with headquarters in Toronto, succeeding *H. V. Gigandet*, vice-president, who has retired.

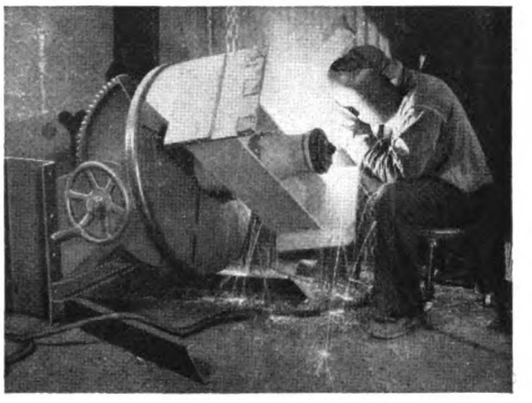
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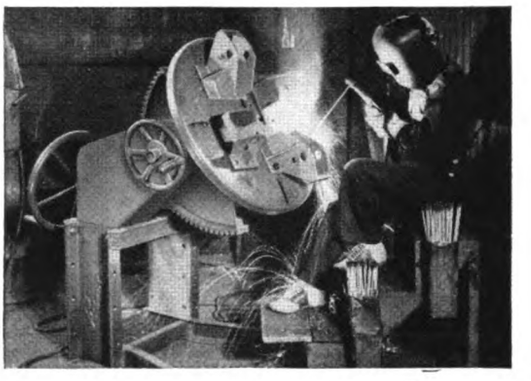
DETREX CORPORATION.—*William F. Lucas* has been appointed as assistant to E. H. Ehlert, western region manager of Detrex Corporation, Detroit, Mich. Mr. Lucas, who will have headquarters in the Chicago office, 600 South Michigan avenue, will supervise the technical applications and the field servicing of Perm-Cote, phosphate-type of rust-proofing compounds, and Detrex alkaline

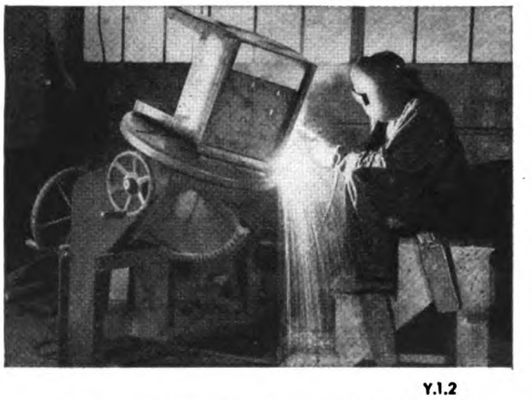
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in more production . . . better welds . . . less rod waste

The universal table top makes the Worthington-Ransome Welding Positioner as profitable on *job* work as it is in mass production.

Those "T" slots make the table adaptable to any shape of work piece and a wide range of sizes. No special jigs or fixtures needed.

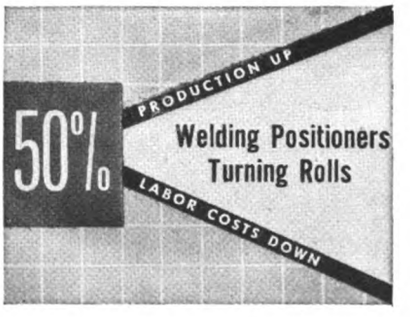
Result—up to 50% more footage, *better* welds (using higher current and heavier rods), less welding rod waste.

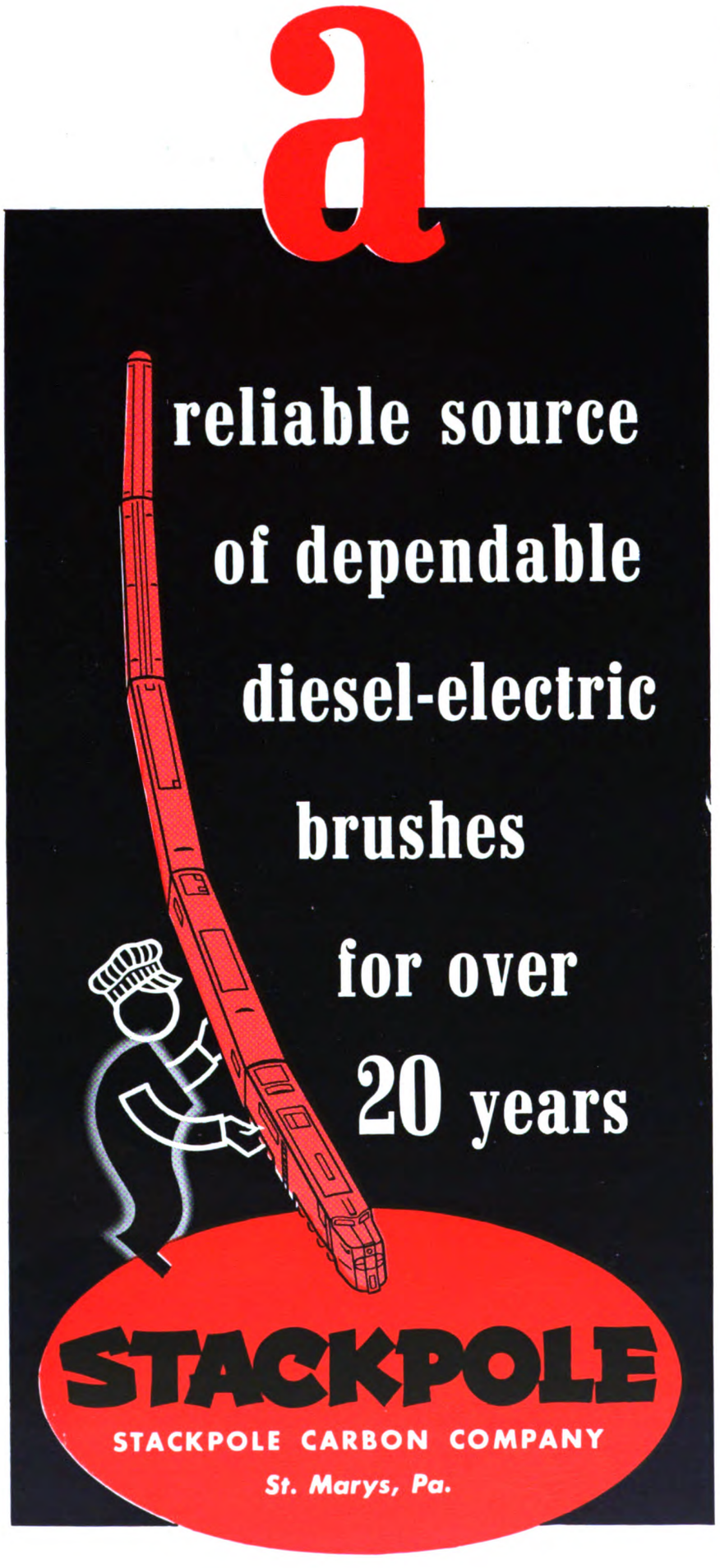
Welding positioner capacities from 100 lb to 30 tons. Also: turning rolls from 3 to 150 tons, stationary or self-propelled.

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Y.1.2

WORTHINGTON





and emulsion cleaners, in Wisconsin and northern Illinois.

◆

NATIONAL STEEL CAR CORPORATION.—*Alex P. Shearwood* has been appointed vice-prsident of the National Steel Car Corporation of Montreal, Que., and Hamilton. Ont.

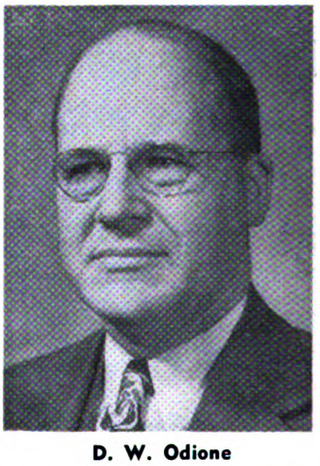
◆

EDGEWATER STEEL COMPANY.—The Edgewater Steel Company has moved its Chicago office to Room 1142, Merchandise Mart Plaza, Chicago 54.



A. J. Couse

A. J. Couse, district manager of Chicago and St. Louis, Mo., territories of Edgewater



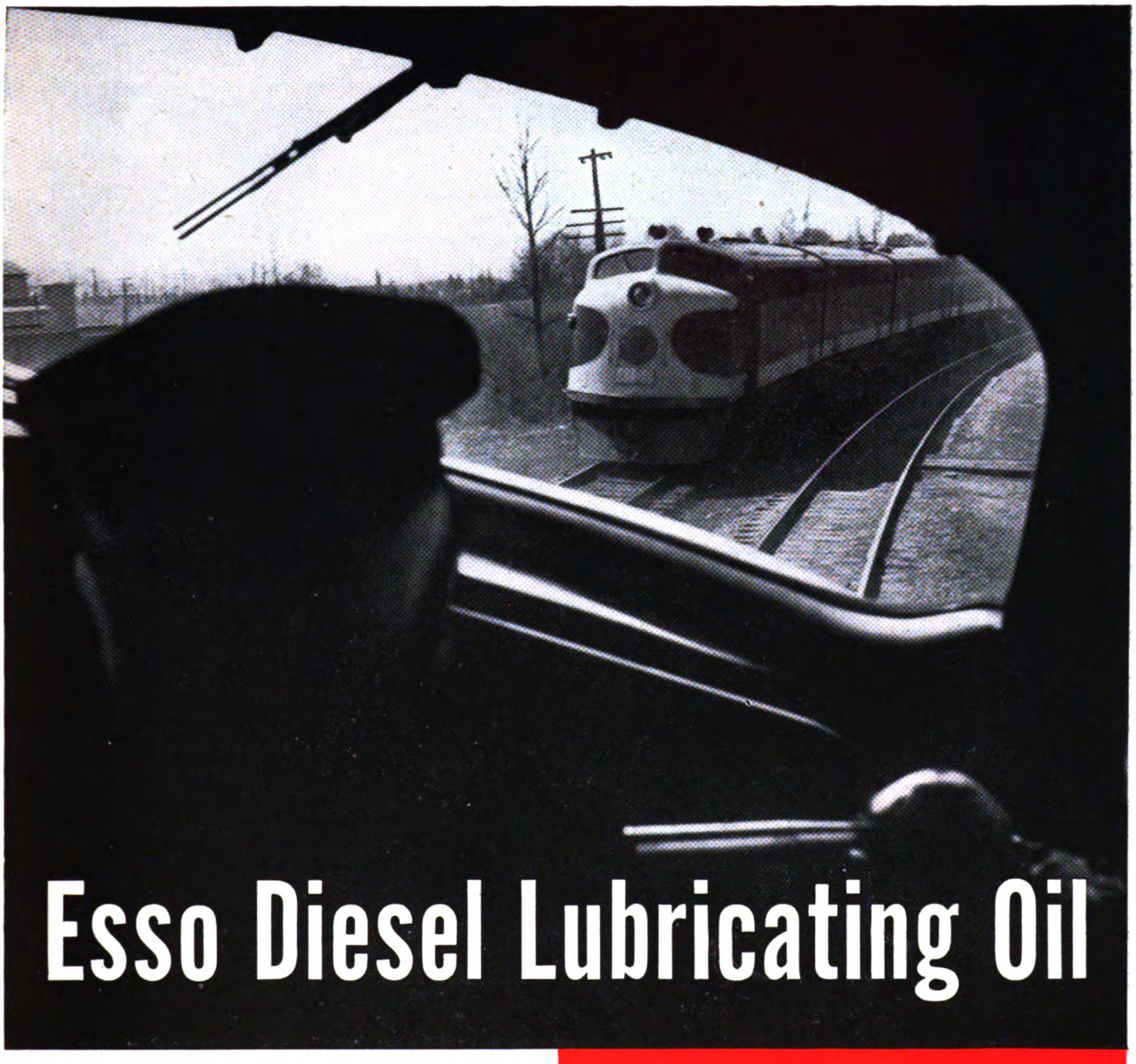
D. W. Odione

Steel Company, has been appointed assistant to the vice-president and general sales manager at Pittsburgh, Pa. *D. W. Odiorne*,



W. O. Fleming

"Tailor-made" for Railroad Diesels



Esso Diesel Lubricating Oil

A HIGH-QUALITY LUBE FOR REAL PROTECTION —Esso offers "tailor-made" diesel locomotive lubricating oil (Diol RD) developed through years of field testing and research by both engine designers and Esso scientists to meet needs of railroad diesels. High-quality Esso Diol RD gives dependable lubrication protection.

BACKED BY CONSTANT RESEARCH—continuing tests in the lab and on the road make sure that Diol RD keeps pace with progress and latest developments in railroad diesels.

BACKED BY CONSTANT FOLLOW-UP — on-the-job check-ups by Esso Sales Engineers watch the dependable performance of Esso Railroad Fuels and Lubricants. Be sure to call on Esso for any railroad fuel or lubricating problem.

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The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

railway engineer, succeeds Mr. Couse as district manager. *W. O. Fleming* has been appointed metallurgical engineer and assumes the duties previously handled by Mr. Odiorne.

PERSONAL MENTION

General

F. E. MOLLOY, assistant superintendent motive power of the Southern Pacific, has been appointed to superintendent motive power at the Sacramento, Cal., general shops. Mr. Molloy started service with the S. P. as a machinist at Douglas, Ariz., in 1925 after 12 years' service with other roads. Later he held various positions, including general enginehouse foreman and master mechanic. In 1942 he became assistant superintendent motive power at Los Angeles, Cal., and in 1944 assistant superintendent motive power at Sacramento.

HENRY REDMORE NAYLOR, works manager of the Angus shops of the Canadian Pacific at Montreal, Que., has retired on pension.

H. T. COVER, chief of motive power of the Pennsylvania at Philadelphia, Pa., has been appointed also assistant vice-president in charge of operation. Mr. Cover was born at Altoona, Pa., on August 25, 1897, and attended Pennsylvania State College (B. S. in E. E. 1919). He entered railroad service in August, 1915, with P. R. R. as laborer at Altoona, subsequently serving as boilermaker helper, draftsman, special apprentice, motive-power inspector, assistant shop foreman, shop foreman, assistant master mechanic and master mechanic. In January, 1940, Mr. Cover was appointed superintendent of the Wilkes-Barre division and two years later, superintendent freight transportation at Philadelphia. He was named general superintendent of the Eastern Ohio division at Pittsburgh in August, 1942, and became chief of motive power of the system in March, 1946.



H. T. Cover

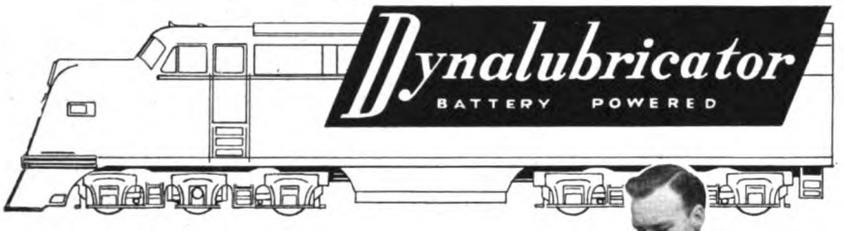
F. E. RUSSELL, superintendent motive power of the Sacramento, Cal., general shops of the Southern Pacific, has gone to Washington, D. C., on special assignment as consultant to serve as chief of the roadway, equipment and manpower branch of the Railroad Division, Defense Transportation Administration.

W. W. MATZKE has been appointed to chief mechanical engineer of the Chicago & North Western System, as noted in the June issue, was born on December 28, 1907, at Duluth, and received his bachelor's degree in mechanical engineering



W. W. Matzke

REVOLUTIONARY



PUMPS HEAVIEST GEAR CASE LUBRICANTS



ELIMINATES MESSY HAND-DISPENSING

AUTOMATICALLY PUMPS MEASURED AMOUNTS

With the DYNALUBRICATOR modern shops are now servicing every gear case of a 3-unit locomotive *in just 10 minutes! Exact amounts* of lubricant assured by automatic metering and cut-off device. *No-Drip Nozzle* gives convenient, positive control over grease flow, eliminates messy dripping. Lubricants kept at working temperature automatically. Battery power eliminates trailing wires during operation. Easily handled by one man.

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A PRODUCT OF BROWN DYNALUBE MANUFACTURING CO.



How Shippers Benefit from the Erie's Progressiveness

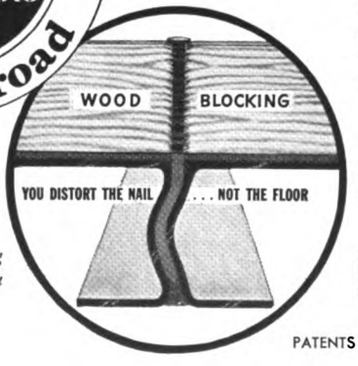
As a new century dawns for the Erie Railroad, its present management looks forward with vigor and vision.

Shippers recognize the Erie's progressiveness, for instance, when they see the NAILABLE STEEL FLOORING stencil on its boxcars and gondolas.

Shippers know that N-S-F and its exclusive nailing feature mean greater security for lading of all kinds—bulk, bagged, boxed or blocked. They know that N-S-F assures effective prevention of loss and damage claims plus greater all-round versatility of rolling stock.

1851 ERIE 100th ANNIVERSARY *Great Lakes to the Sea* 1951
Erie Railroad

The Erie is one of 40 progressive roads using N-S-F



Greater holding strength when you nail to N-S-F

GREAT LAKES STEEL CORPORATION
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PRODUCER OF HIGH-TENSILE STEEL

NATIONAL STEEL CORPORATION

PATENTS PENDING

51-SF-8

Two years of testing have indicated . . .

when you **STOP** axle movement

you **STOP** bearing displacement

therefore **STOP** HOT BOX TROUBLE!

with



Tough, oil-impervious, shock-resistant Neoprene permanently and *inseparably* bonded to steel inserts (dotted lines). Placed in dust-guard well, the *Axle-Stop* restricts journal movement to ⅛ inch!

Here's new **engineered** precision in journal box assembly that promises the first **real** relief from hot box troubles!

Restriction of journal movement is the answer. **Axle-Stop** has had 312,000 miles of service which bears out laboratory and motion-picture findings—that **prevention of axle displacement reduces waste grab, the most common cause of hot boxes!**

axle stop

AXLE-STOP, INCORPORATED

1830 N. Sheffield Avenue, Chicago 14, Illinois

from the Universty of Minnesota in 1929. He began his railroad career with the Duluth, Missabe & Northern (now Duluth, Missabe & Iron Range) during summer vacations, starting to work full time in 1929. From 1934 to 1944 he was associated with the Hartford Steam Boiler Inspection & Insurance Co. Subsequetly he became associated with the North Western and served successively as engineer power plants and machinery, mechanical engineer and assistant to chief mechanical officer.

PATRICK M. SULLIVAN, superintendent, motive power and cars, of the Duluth Missabe & Iron Range, at Proctor, St. Louis, Mo., has retired after 49 years of service on the road.

ROBERT H. SEITZ has been appointed superintendent, motive power and cars, of the Duluth, Missabe & Iron Range, with headquarters at Proctor, St. Louis, Mo.

W. D. DICKIE, assistant works manager, locomotive, of the Angus shops of the Canadian Pacific at Montreal, Que., has been appointed works manager.

Car Department

W. KENDRICK FARMER, whose appointment as mechanical engineer—cars of the Chicago & North Western at Chicago, was reported in the June issue, was born on September 26, 1908, at Louisville, Ky. Mr. Farmer started with the North Western in May, 1927, as a tracer and detailer in the mechanical department. Subsequently he held various positions and prior to becoming mechanical engineer was draftsman-estimator.

Diesel

F. G. BAKER, formerly assistant superintendent of motive power, of the St. Louis-San Francisco, has been placed in charge of a diesel department which has been organized by the Frisco to bring under one head diesel inspection and repair. Assisting Mr. Baker is a general supervisor of diesel maintenance, while diesel supervisors—all newly-created posts—have been assigned to each of the road's seven divisions under supervision of the master mechanic on each division. Under the new department an intensified educaitonal program will be inaugurated to train mechanics at each of the Frisco's diesel shops. Crew instruction will be conducted over the system through a special school car.

G. O. WHITESELL has been appointed diesel supervisor (system) of the Seaboard Air Line, with headquarters at Jacksonville, Fla.

R. W. MURRAY has been appointed diesel instructor of the Seaboard Air Line at Jacksonville, Fla.

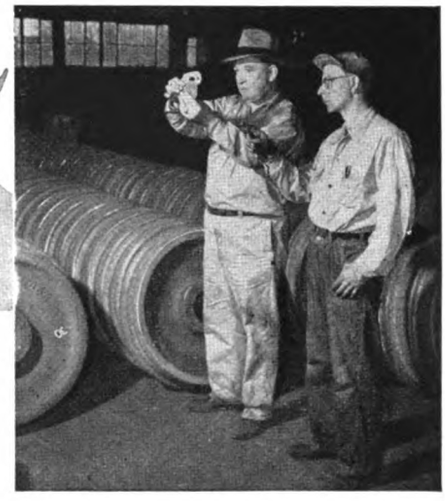
Master Mechanics and Road Foremen

H. B. ROBINSON, general foreman, locomotive department, of the Norfolk & Western at Roanoke, Va., has been appointed to the newly created position of assistant master mechanic, Scioto division.



Resident inspector (left) and general inspector (right) checking the records of a day's run in a chilled car wheel plant. The aim is uniformity from plant to plant in making every wheel as good as the best.

One of the duties of the AMCCW general inspector is to check all gages in use by resident inspectors against his master gages. Here he is seen inspecting the flange thickness gage. The chilled car wheels in the background are ready for shipment.



How inspection makes sure chilled car wheels can take it!



Every AMCCW wheel is tested for rotundity. The steel ring shown in photo must fit to .030" of perfection before the wheel is approved for service. If the wheel fails this exacting test, it must be ground to within .015" of perfect rotundity, or half the permissible limit.

Checking begins with the melt—even before an AMCCW wheel is poured. And never lets up until the wheel is okayed for use.

The AMCCW resident inspector in every AMCCW plant keeps elaborate records of every AMCCW wheel made... checks molding methods ... watches pouring temperatures... supervises rotundity tests... selects wheels for the daily drop and thermal tests. He is responsible, too, for all gages and pyrometers used in the plant.

In addition, a general inspector from Association headquarters spends a week every six months in each AMCCW plant, checking inspection methods and equipment, reviewing the records as shown above and checking all operating details that affect wheel quality, from the cupola to the shipping platform.

Accurate and detailed inspection like this, coupled with the new AMCCW wheel, with its heavier rim and stronger flange, means even higher safety records.

AMCCW

Low first cost
Low exchange rates
Reduced inventory
Short haul delivery
Increased ton mileage
High safety standards
Complete AMCCW inspection
Easier shop handling

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

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American Car & Foundry Co. • Southern Wheel (American Brake Shoe Co.)
Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • New York Car Wheel Co.
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HERE'S
Half a Ton OF Pull — TOOL-BELT SIZE!

The New 1000-lb. Mighty Midget Puller

ONLY $31.00
($21.75 for 500-lb. Model)

Combining easy portability with added pulling power, the new Coffing Mighty Midget does more jobs, does them *easier*. Only 9½ lb. in weight, it fits neatly in a tool box or hangs lightly on a tool belt. Full half-ton capacity gives it plenty of power for pulling pistons, removing and installing heavy parts of all kinds, other shop work. Convenient 2-way handle serves as a lever or high-speed crank.

- Make the Mighty Midget Puller a standard tool in your shop. See how its added strength and easy portability save muscles while it speeds many phases of maintenance work. Write for Bulletin H7MP.

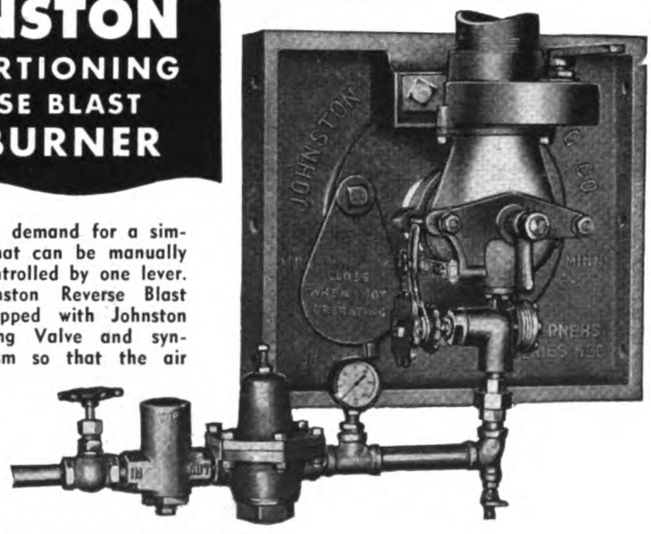
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For *Economical, Efficient* Oil Heat . . .

JOHNSTON PROPORTIONING REVERSE BLAST OIL BURNER



Designed to fill the demand for a simplified oil burner that can be manually or automatically controlled by one lever. The standard Johnston Reverse Blast Oil Burner is equipped with Johnston Fueltrol Proportioning Valve and synchronizing mechanism so that the air and oil balance is maintained in the same ratio at any setting between low and high fire. This burner is a compact unit and is shipped ready for mounting on your furnace. For use with fuel oils.

Write for Bulletin R-508.

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ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

CHARLES C. PLANT, SR., has been appointed road foreman of engines of the Southern at Spencer, N. C.

J. VANCE DAVIS, road foreman of engines of the Southern at Spencer, N. C., has been appointed general road foreman of engines at Spencer.

WALTER S. ANGEL, general road foreman of engines of the Southern at Spencer, N. C., has retired after more than 49 years of service on the road.

WILLIAM O. BROWN, master mechanic of the Southern Pacific at Brooklyn, Ore., has been appointed assistant superintendent motive power at Sacramento, Cal. Mr. Brown began his S. P. career as a machinist apprentice on the Texas & New Orleans at Houston in 1934. Subsequently he advanced through various posts in the mechanical department, and in 1946 became master mechanic at Dunsmuir, Cal. Two years later he was transferred to Brooklyn.

H. R. HILSINGER, special duty engineman of the Pennsylvania, has been appointed assistant road foreman engines, Philadelphia Terminal division, Philadelphia, Pa.

C. G. BENKENDORF, has been appointed master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis.

Shop and Enginehouse

W. VAUGHN STEVENS has been appointed assistant enginehouse foreman (night) of the Southern at Chattanooga, Tenn.

H. A. FETTIG, foreman, at the 46th street enginehouse, Philadelphia, Pa., of the Pennsylvania, has been appointed general foreman—locomotives at the Wilmington, Del., shops.

E. I. SALO has been appointed enginehouse foreman of the New York Central at Hillsdale, Mich.

H. R. WILSON, assistant enginehouse foreman of the Norfolk & Western at Shenandoah, Va., has retired.

NICHOLAS E. MAGETTE has been appointed general enginehouse foreman of the Southern at Chattanooga, Tenn.

J. A. SCHWILM, foreman at the Meadows, N. J., enginehouse of the Pennsylvania, has been appointed enginehouse foreman at Erie, Pa.

O. T. HARMON, JR., has been appointed assistant enginehouse foreman (night) of the Southern at Chattanooga, Tenn.

A. B. JOHNSTON, foreman at the Elmira, N. Y., enginehouse of the Pennsylvania, has been appointed foreman at the 59th street, Chicago, enginehouse.

J. C. HOEGER has been appointed general foreman at the Air Line Junction enginehouse of the New York Central at Toledo, Ohio.

Obituary

THOMAS C. SHORTT, chief mechanical officer of the Nickel Plate Road, died in his office in the Swift Building, Cleveland, Ohio, on June 22.



MEMBERSHIP ROLL

UNIT TRUCK "1000" - CLUB

OVER 10,000 CAR SETS

ATLANTIC COAST LINE
BURLINGTON
GENERAL AMERICAN TRANS. CORP.
LOUISVILLE & NASHVILLE
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NORTHERN PACIFIC
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2 – 3,000 CAR SETS

AMERICAN REFRIGERATOR TRANSIT
ARMOUR CAR LINES
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FRUIT GROWERS EXPRESS
ILLINOIS CENTRAL
LEHIGH VALLEY
NASHV. CHATTANOOGA & ST. LOUIS
VIRGINIAN

1 – 2,000 CAR SETS

CANADIAN PACIFIC
*CHICAGO & EASTERN ILLINOIS
CHI. ST. PAUL, MINNEAPOLIS & OMAHA
DENVER & RIO GRANDE WESTERN
DETROIT, TOLEDO & IRONTON
*ELGIN, JOLIET & EASTERN
NEW HAVEN
*SOO LINE
SOUTHERN PACIFIC
*SPOKANE, PORTLAND & SEATTLE
*UNION PACIFIC
*WABASH
*WARREN MARITIME CORP.
*WESTERN FRUIT EXPRESS

*NEW MEMBER

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BANGOR & AROOSTOOK RAILROAD
UNITED STATES ARMY
BUFFALO CREEK RAILROAD

Yes! - It's the World's fastest growing Railroad Club

AUGUST, 1951
VOLUME 125
No. 8

RAILWAY Mechanical and Electrical Engineer

Founded in 1832 as the American Rail-Road Journal.

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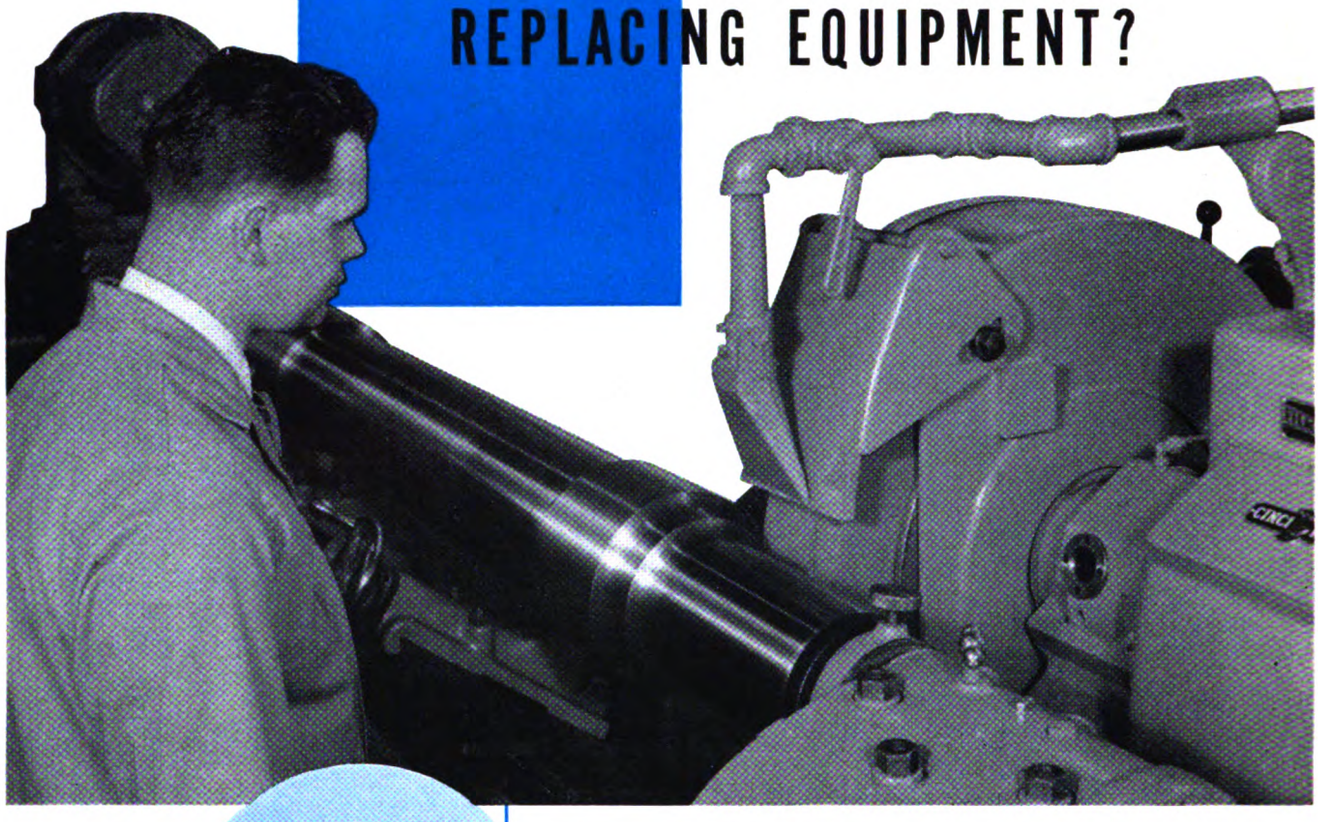
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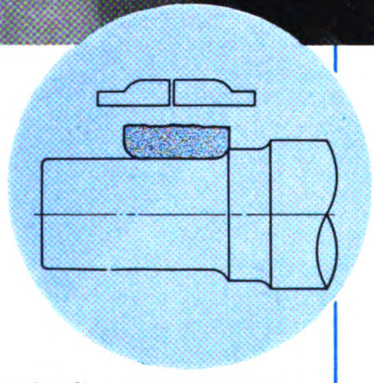
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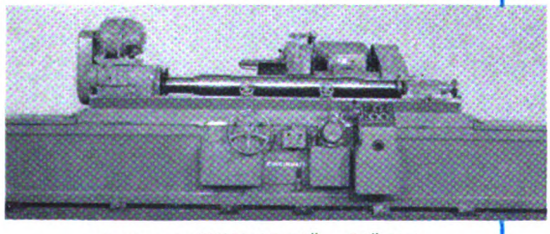
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Of all the Mechanical Division subjects discussed at Chicago these appear to demand special attention

At the opening session of the twenty-fifth annual meeting of the Mechanical Division, Association of American Railroads, held at the Congress Hotel, June 26 to 28, W. H. Schmidt, Jr., western editor, Railway Age told railroad men that it is their responsibility to convince other businesses that the large segment of the country's transportation plant which is publicly owned should be paid for on a business-like basis and in his remarks traced a parallel between conditions now existing in this country and those which produced the socialization of the railroads, trucks and canals in Great Britain. At the same session J. H. Aydelott, vice-president, Operations and Maintenance Department, A.A.R., outlined the problems which the railroads face during the coming months as a result of defense mobilization activities.

W. J. Patterson, member, Interstate Commerce Commission, addressed the meeting on the second day, calling attention to a number of conditions affecting safety which are in need of improvement.

The opening session began a program for the presentation and discussion of 17 technical reports. During the meeting the following were elected to serve as members of the General Committee for a two-year term expiring in June 1953: F. K. Mitchell, manager equipment, New York Central system; A. G. Kann, general superintendent equipment, Illinois Central system; G. W. Bohannon, chief mechanical officer, Chicago & North Western; E. R. Battley, chief motive power and car equipment, Canadian National, and D. S. Neuhart, general superintendent motive power and machinery, Union Pacific. Officers were elected at the last annual meeting to serve two-year terms and none was elected this year.

In its report the General Committee called attention to the fact that the board of directors of the A.A.R. at a meeting on November 16, 1950, unanimously approved the proposed standard floor plans for passenger-train cars as prepared by the Passenger Car Design Committee of the American Railway Car Institute in cooperation with the Committee on Passenger Car Specifications of the Mechanical Division for submission to the member roads as recommended practice. It also called attention to the annual meeting of the Coordinated Mechanical Associations which will be held at Chicago September 17-19. The committee recommends that mechanical departments of member roads allow as many of their supervisory officers as possible to attend these annual conventions and examine the exhibits which will be assembled in connection with them.

Presiding during the meeting was B. M. Brown, general superintendent of motive power of the Southern Pacific, the chairman of the division. Other officers of the division are H. T. Cover, chief of motive power, Pennsylvania, vice-chairman; V. R. Hawthorne, executive vice-chairman, unable to be present because of illness; Fred Peronto, secretary; and J. R. Jackson, mechanical engineer.

In tracing the parallel between conditions now existing in the United States and the pressures which produced the socialization of railroads, trucks, canals and docks in Great Britain 3½ years ago, Mr. Schmidt said:

"Ideology—the socialist's timetable—obviously was an important reason for Britain's step. So also was the long-held belief by railroad employees that their lot would be bettered through government ownership. But equally important was the conviction by many—including many adherents of the Conservative and Liberal parties who are businessmen—that the privately owned, taxed and self-sustaining railroads could not cope with the loss of traffic to trucks and buses on the public highways.

"Our own railroads here must exist in a climate far more hostile than that which existed in Britain before socialization. Public aids to highway and air transport here are much bigger and more serious than they were in Britain. The outright support of inland waterways from general taxation, which is common here, did not obtain in Britain. Thus, while we have neither doctrinaire socialists nor unions which consistently support government ownership, we have the third disease in a more virulent form than it existed in Britain; i.e., public support of competing forms of transport in so unbusinesslike a fashion that their prices to the public are artificially depressed and bring about progressive diversion of traffic from privately supported transport facilities."

Mr. Schmidt pointed out that pressure for continued public subsidization of air, water and motor transportation does not come, for the most part, "from long-haired



V. R. Hawthorne
Executive vice-chairman



B. M. Brown
Chairman



H. J. Cover
Vice-chairman



F. Peronto
Secretary

A. A. R.
Mechanical Division
General Committee
1950-51



J. R. Jackson
Mech. Eng.



R. G. Henley



F. K. Mitchell



A. G. Kann



A. K. Galloway



G. W. Bohannon



J. P. Morris



M. R. Brockman



E. R. Battley



D. S. Neuhart



J. F. Ryan

radicals, from union leaders, or from the public in general."

To get justice, he asserted, the railroads must first convince the leaders of other businesses that the present policies they advocate are leading to complete socialization of all transport. "No businessman," he said, "can look on the experience of Britain during the past three and one half years and regard that prospect with indifference.

"The fact that the railroad employees of Britain are far from pleased with the working-out of government ownership of transport—and say so openly and bitterly —is an important argument by which our railroads can rouse their own employees to action against influences which weaken the railroads and will, if unchecked, lead surely to government ownership of all transport."

Materials, Manpower and Fuel

Mr. Aydelott classified the pressing problems faced by the railroads during 1951 under three heads: materials, manpower, and fuel. The difficulties of securing an adequate supply of materials, he said, arise primarily from the demand for our own and our European allies' defense effort. Part of the increased demand for freight cars, he said, arises from the increased volume of production in many fields since the close of World War II. The railroads, he said, have bragged too much about their capacity to meet emergencies. He stressed the need of more cars now, pointing out that, because of the tremendous rate at which old cars have been retired, the gain in the number of freight cars in the 12 months ended May 31 was less than 3,000.

The Defense Transport organization has supported the railroads' effort to overcome the shortages of the past year and its heavy loading orders have helped some, but Mr. Aydelott is not sure whether these orders have been saving cars or only have seemed to do so, causing the railroads to lose business to the highways. One of the dampers on the enthusiasm of the public in support of the mobilization effort is the maintenance of the five-day week. As long as this is continued, Mr. Aydelott feels that it will be difficult to secure hearty support in carrying out measures to save car-days by heavy loading and prompt loading and unloading.

Mr. Aydelott dealt with the effect of the new draft law which discourages deferments by extending the termination of the obligation to render military service from the age of 28 years to 35 years for deferred men. He told of the management manpower committees which have been set up at large employment centers on which there are railroad members and said that the railroads would soon be advised of the personnel and locations of these committees. These committees, he believes, will give the railroads an "even break" in the distribution of manpower.

While the railroads are consuming as diesel fuel only two per cent of total petroleum production, Mr. Aydelott said that diesel fuel is becoming competitive with heating oils and with the large amounts of kerosene being used for jet plane propulsion. He urged the Mechanical Division to study diesel fuel specifications to find out how much certain characteristics of the fuel could be lowered to increase the base of supply without causing operating difficulties.

In closing, Mr. Aydelott said that every statistical yardstick of maintenance and operating efficiency had improved in 1950. But, he said, hot boxes are still an acute problem and, to solve it, there must be 100 per cent observance of all of the requirements of the rules.

Disturbing Defects

Chairman Brown, in summing up the problems before the Mechanical Division, laid emphasis on defective equipment and the continuing hot-box problem. He said, in part:

"Defective equipment, particularly freight cars, continues to be one of the prevalent causes of accidents, derailments, lading damage and delays to freight in transit.

"The report of the Committee on Train Accidents of the A.A.R. Safety Section, dated May 4, 1951, shows that during 1950, 34 per cent of train accidents resulted from defects in or failure of equipment; and the trend has been generally upward for the past 10 years.

"Serious accidents have occurred this year from such causes as broken truck frames, couplers dropping on rails, burned off and broken journals, defective wheels, brake rigging coming down and other items of equipment defects.

"Letters have been issued on several occasions since January 1 of this year by the executive vice-chairman of the division, calling attention to many items of car maintenance that are causing trouble and in need of special attention. Among these are maintenance of dust-guard plugs and seals and journal-box lids to keep rain, snow and foreign matter from contaminating box packing; the application of heavy coats of paint or other protective coatings to truck side frames and bolsters in violation of the rules, nullifying proper inspection; importance of cleaning drain holes in the bottom section of truck side frames to avoid excessive corrosion; importance of proper inspection and repairs while on repair track to couplers, draft gears and attachments, truck sides and truck bolsters, journal boxes, brake beams, hangers, safety supports, piston travel, leakage in the brake system, safety appliances and condition of wheels to see that cars are in good condition for safe transport and to avoid shopping of the car under load, causing delay to car and contents.

"One of the most aggravating problems still confronting the railroads is the perennial hot box. Higher sustained operating speeds and fewer stops with diesel locomotives, greater utilization of equipment, improved yards and signaling and other factors of modern railroading, have all contributed to this problem. Hot boxes not only delay the steady flow of essential traffic, but also involve serious hazard of accident.

"This is not a new subject before this division and it has not been neglected. The General Committee and the other committees of the division have continued to give it serious study, and during the past year have taken emergency action to improve specifications for packing and journal box oil. Other action taken includes reducing the period for repacking journal boxes from 15 months to 12 months; increasing the mechanical inspection staff for the purpose of itensifying checking into journal-box lubrication practices; encouraging the use of packing retaining devices; increasing and broadening personnel and representation of the Committee for Lubrication of Cars and Locomotives; and continuing research to improve the design of bearings and quality of lubricating materials.

"The efforts are in the right direction, but the results have been disappointing. Hot boxes are still causing serious trouble; some of us may be inclined to blame foreign cars and minimize our own shortcomings. The solution lies in the hands of each individual railroad which must adopt sound maintenance, inspection and lubrication practices, secure the proper materials, and

establish operating rules that will permit proper application of these practices, and all departments on the railroads must cooperate to bring this situation under control."

High Speed and Heavy Loads

William J. Patterson, I. C. C. commissioner, in commenting on the many equipment problems that are confronting the railroads today, said, in part:

"Recent developments in motive power and cars have contributed to a considerable extent toward train operation at higher speeds with long and heavier trains traveling greater distances without intermediate stops. This trend put a greater responsibility upon mechanical officers to know that the design and maintenance of equipment is adequate to meet the demands. Failure of truck frames, wheels, axles, couplers, other portions of car structures, or power brakes can be disastrous, not only in so far as a particular train is concerned, but to other trains occupying the same or adjacent tracks.

"A major problem today is the failure of steel wheels. In modern passenger-car construction the four-wheel truck has, generally speaking, replaced the six-wheel truck. Total weight reduction, if any, in the so-called light-weight passenger car is slight and as a result the individual wheel loading has been increased considerably. This increase in wheel loading, together with greater speeds and higher braking ratios, has resulted in numerous wheel replacements because of thermal cracking. The prevention of serious accidents because of wheel failure must necessarily require frequent and thorough inspection by competent employees.

"The number of cases where driving wheels under diesel locomotives have failed because of thermal cracking, fractures originating at the hot stamp markings, or progressive fractures originating in rims and plates because of the development of excessive internal stresses, is alarming. Yet we find that regular runs are being lengthened considerably and with little or no inspection at intermediate terminals. During the early part of this month we investigated the derailment of a passenger train which resulted in injury to a number of passengers and employees, which was caused by the failure of a 36-in. Class C driving wheel under the second unit of a two-unit diesel locomotive. The train was accelerating after making a regular station stop and had reached a speed in excess of 60 mph. when 57 in. of the rim broke out of the wheel. After severely damaging the rails for a distance of more than 1,400 ft. this pair of wheels was derailed and then continued on the track structure for another 1,200 ft. before coming in contact with a switch and damaging the track to the extent that the following eleven cars of a 13-car train were derailed. This accident occurred on the westward track of a double track line and both main tracks were obstructed by the derailed cars. Approximately eight minutes later an east-bound passenger train was brought to a stop by a flagman at the scene of the accident. Had there been a slight difference in the timing the results might have been far worse.

"Examination of the wheel after the accident disclosed that there were four old progressive fractures in the rim and plate. One of the fractures. approximately 1½ in. below the rim, extended through the plate for a longitudinal distance of more than 16 in.

"One other serious factor in considering diesel wheel failures is the fact that enginemen, riding in the control compartment of the leading unit, are not in a position to readily detect defects in the running gear of trailing units. This is clearly illustrated in the derailment to which I have just referred. In this case the enginemen were not aware of anything being wrong until the train had parted, causing an emergency application of the train brakes, although the broken wheel had badly damaged the rails and had been derailed for a total distance of almost 2,700 ft. before the general derailment occurred.

"This is a serious matter. Railroad officers and members of the special joint committee consisting of representatives of manufacturers and railroads should give prompt and serious consideration to this problem.

"The service demands upon our freight-train power brakes have become severe in recent years. We find a large number of cars with the obsolete K type brakes still in service and, even more alarming, we find considerable evidence of lack of proper maintenance on cars equipped with AB brakes.

"Although the investigation, which led to the adoption by this division of the AB brake in 1933 and to our order of September 21, 1945, in Docket No. 13528, was instituted in 1922, we find that as of March 31 of this year there were 116,518 cars of U. S. ownership still in interchange service with the K type brake. Of this number, 76,241 are scheduled for conversion to AB brakes and the remaining 32,393 scheduled for retirement.

"In view of the current shortage of cars we found it necessary in the public interest to further amend our order of September 21, 1945, in Docket No. 13528, so as—

'To require that all cars be equipped with AB brakes or or before June 30, 1952, except as indicated hereinafter:

'To prohibit the movement by any respondent after June 30, 1952, of any of their cars used in freight service not so equipped unless such car is received in interchange from a line other than the owning line or unless such car is moved on its own rails by an owning line; and

'To prohibit the movement by respondents after December 31, 1952, of any car used in freight service (including the cars of private carline companies) not so equipped.'

"Your committee members have been negotiating with representatives of our Bureau of Safety for some time relative to the rules contained in the pamphlet entitled 'Maintenance of Air Brake and Air Signal Equipment on Locomotives and Cars.' Considerable progress has been made toward formulating a satisfactory set of rules, but up to this time no provision has been made to insure compliance with such rules. Rules not uniformly complied with and which are not enforced are of but little value. The difficulties experienced during the last few winters with excessive brake pipe leakage, only a portion of which was a result of inferior material, the excessive number of inoperative power brakes found by inspectors of the Bureau of Safety while making terminal air-brake tests, and observations made at various train yards and repair tracks are indications of failure on the part of many railroads to properly comply with the existing air-brake maintenance rules. One of the most destructive elements to safe operation of a railroad is the tolerance of rule violation. It is evident that there is a need for some action to make these rules mandatory and for some provision to insure proper compliance by all member railroads.

"Even though all cars were equipped with AB brakes and properly maintained the power brake situation would not be entirely satisfactory. The wide range in braking ratio of from 18 per cent, or often lower, to 75 per cent

or higher of the weight of a car results in unequal braking and serious damage to equipment and lading, particularly in the operation of long trains.

"Some minor changes in design have been made by the manufacturers of the ABLC variable load brake. These improved devices have been in service on 398 lightweight hopper cars for almost two years and, I understand, have been functioning very well. If this brake has been sufficiently developed to properly reduce the range in braking ratios between empty and loaded cars action should be promptly taken to make it standard where necessary to obtain proper spread in braking ratio.

"As a member of the Committee on Harriman Awards I have been much interested in the past few years with respect to the manner in which injuries sustained by railroad employees are being reported to the Commission. I have noted that the greatest opportunity for the occurrence of these injuries appears to be in connection with maintenance, both mechanical and right-of-way. undoubtedly this is partly due to the nature of the work performed, but the accident records also indicate that carelessness is a heavily contributing factor. A great many injuries result from carelessness of fellow worker and it behooves each man, not only to consider his own safety while at work but also that of those working with or near him.

"With respect to reporting injuries to the Commission as required by law and rules, I am quite disappointed. The files show that many injuries that should have been reported were not included in the reports. With some carriers there can be little doubt but that this has been done deliberately, but in most instances ignorance of the Commission's reporting rules seems to be the underlying cause. I am led to believe that the majority of foremen and supervisors do not have a correct understanding of the reporting requirements; many of them are under the impression that if the injured party can report for duty within the three-day period and is able to perform some portion of his duties, this is all that is necessary to remove the injury from the reportable class.

"This understanding of the rule governing reportable injuries is not correct. Under the rule the employee must be able to perform *all* the usual duties of his occupation without assistance, and not merely certain work that he may be able to do during recovery. Many foremen and supervisors believe that if the employee can report for some sort of work without loss of payroll time in excess of three days, the injury is not reportable. Loss of payroll time is not to be considered. The determining factor is the period the employee is prevented by the injury from performing any and all the usual duties of his occupation.

"I might also mention that a severe penalty is provided by law for failure to report injuries as required bv the Commission's reporting rules and regulations. The fine for each violation mav be as much as $100 per day for each day beyond the 30 days allowed in which to file the reports. This might easily prove costly and some roads have paid fines for failure to report injuries.

"You should not allow zeal for a good personal injury record in your department to subject your employer to liability of court action and possibly heavy fines. Remember that in determining whether an injury is reportable, the reporting officer must depend to a great extent on the information furnished him.

"The Locomotive Boiler Inspection Act of 1911, as amended, and the rules prescribed thereunder establish minimum safety requirements for steam locomotives and locomotive units propelled by power sources other than steam.

"It is significant that safety, dependability, economy and road performance are characteristics that change with and are dependent upon the physical condition of locomotives. It is generally recognized that a high standard of maintenance will result in a high standard of safety. We also know that proper inspection and adequate repairs are essential to reliable and durable locomotives and that the attendant costs per unit of transportation are less than for indifferently maintained locomotives.

"The rapid transition from steam power to use of diesel-electric locomotives has been accompanied by the usual problems incident to what may be termed a revolution in motive power. Facilities for maintenance of steam power are not usually suitable for diesel-electric locomotives; personnel trained in steam locomotive maintenance must be re-educated, and the responsibility placed upon supervisory officers has been increased.

"Some of the features of diesel-electric locomotive operation which our experience indicates should be given careful attention are: Maintenance of clean engines, fuel-oil tanks and electrical equipment. Oil upon floors of passageways has resulted in numerous injuries as a result of falls. Dirty and fouled electrical equipment has caused flash overs and resultant injuries and fires have resulted from debris on fuel-oil tanks.

"Crane-case explosions resulting from improper maintenance of engines and lubricating systems have been the source of a number of injuries.

"Lubrication failures of support bearings or traction-motor bearings have caused several serious accidents.

"Operation of diesel-electric locomotives on through runs with cursory and inadequate inspections at intermediate inspection points encourages accidents because defects which develop en route either are not discovered in the superficial inspections made or, if discovered, are passed by on the 'let's take a chance' gamble. I strongly urge that immediate consideration be given to establishment of thorough and meticulous inspections of through trains at intermediate points and positive instructions that units found with reportable and dangerous defects be set out for proper repairs be placed in effect; diesel locomotives do not now carry their fair share of the braking load.

"There are numerous other problems such as obsolete and deteriorated truck frames, hot boxes, defective couplers and draft gears, that you are familiar with and will give consideration."

Locomotive Construction

Auxiliary Air Supply

There have been several accidents involving diesel-electric locomotives in which the brake cylinders were damaged or other damage occurred, which resulted in loss of main reservoir air pressure, and the locomotive unit separated from the train or from its mate units, and continued in motion out of control. At a meeting of the Safety Appliance Committee on June 26, 1950, the matter was assigned to a joint committee consisting of representatives of the Committee on Brakes and Brake Equipment, and the Diesel Section of the Committee on Locomotive Construction.

The Joint Committee met with Commissioner Patterson and other representatives of the Interstate Commerce Commission on August 14, 1950, at which Mr. Patterson proposed a change in the rules to cover the provision of a definite supply of air to operate the controls of a locomotive having a pneumatically

actuated system of power controls, which would be available even though the locomotive suffered complete loss of main reservoir air. The wording of the proposed amendment to the rules was approved by the Safety Appliance Committee at a meeting on September 26, 1950, and was subsequently issued unchanged by the Interstate Commerce Commission on October 4, 1950 under Ex Parte No. 174, Rules and Instructions for Inspection and Testing of Locomotives, Notice of Proposed Rule Making, and an order was issued on January 29, 1951, amending Rule 205 (a) of the Laws, Rules, and Instructions for the Inspection and Testing of Locomotives Other Than Steam, as follows:—

"Each unit that has a pneumatically actuated system of power controls shall be equipped with a separate reservoir of air under pressure to be used for operating such controls, other than brake controls, which reservoir shall be provided with means to automatically prevent loss of pressure in event of failure of main reservoir air pressure, shall have storage capacity to permit not less than 3 complete operating cycles of control equipment and shall be so located that it will not be readily susceptible to damage. Each unit built before January 1, 1951, that has a pneumatically actuated control system of power control shall be so equipped the first time said unit receives repairs of a general nature but not later than January 1, 1952."

The new rule of itself provides only for a supply of air for the operation of the controls, and prescribes suitable tests to insure an adequate supply for the purpose. It does not, however, prescribe how this air is to be used in stopping a locomotive lacking other means. The only obvious means are the dynamic brake, if available and operative, and reversing the traction motors.

The efforts of the joint committee were directed to working with the builders, principally in connection with use of the air provided by the new rule. Following a preliminary meeting on September 21, two additional meetings were held on January 18 and February 21, 1951 to develop the changes required on existing locomotives: (1) To meet the requirements of the new rule as written; and (2) to coordinate the changes required on locomotives of the various builders so that as nearly as possible the procedure required to reverse the traction motors would be identical on locomotives of all manufacturers.

The efforts of the Joint Committee were directed to working with the builders, principally in connection with use of the air provided by the new rule. A preliminary meeting and two additional meetings were held at which an effort was made to develop the changes required on existing locomotives: (1) To meet the requirements of the new rule as writen; (2) To coordinate the changes required on locomotives of the various builders so that as nearly as possible, the procedure required to reverse the traction motors would be identical on locomotives of all manufacturers.

The various builders are prepared to furnish the necessary information direct to the railroads to cover both phases of the subject on existing locomotives, and are aware of the need to furnish new locomotives complying with the new rule which are so arranged that the traction motors can be reversed in the event of loss of main reservoir air pressure.

The subject falls into two main divisions, namely:

(1) Compliance with Rule 205 (a) which provides only for a dependable source of air for operating controls in the event of loss of main reservoir air pressure. (2) Making the supply of air provided under the new rule effective in stopping a locomotive otherwise out of control, by reversing or "plugging" the traction motors.

Under Rule 205 (a) the railroads are required: To provide a supply of air which will be available in the event of loss of main reservoir air pressure; sufficient in capacity to permit three complete reversals of control equipment; and in a location not readily susceptible to damage, on all locomotives delivered after January 1, 1951, and on all locomotives now in service not later than January 1, 1952.

The joint committee's investigation has indicated that with few exceptions diesel-electric locomotives delivered by the builders represented at the meetings were equipped with separate reservoirs isolated by means of a check valve to prevent the loss of pressure in the control air reservoir in the event of loss of main reservoir pressure.

In order to obtain a definite understanding as to what constituted three complete reversals of control equipment, an opinion was requested from the director of the Bureau of Locomotive Inspection. The following is quoted from his reply of January 31, 1951:

"For the purpose of the rule we consider one cycle may be defined as operation of controls actuated by air pressure incident to following described movements:

Throttle lever: Movement from full open to closed position and then to full open position.

Reverse lever: Movement from position for forward movement to neutral position and then to position for reverse movement.

Transition lever: Movement from full advanced position to 'off' position and then to full advanced position."

In many instances it will be necessary to change the supply of air for auxiliaries other than controls from the control air reservoir to direct from the main reservoir, to conserve the supply for controls only. If this fails to comply, the pressure in the control reservoir can be increased. Failing in this, additional reservoir capacity must be installed.

A suggested procedure for conducting tests for compliance with Rule 205 (a) follows:

1. Start engine and charge compressed air system to full pressure. Alternate:—Charge control air reservoir to slightly above specified control air pressure from house air lines.

2. Shut down engine, blocking any alarm relays to eliminate bell ringing. Alternate:—Engine is down; block alarm relays.

3. Set all equipment in RUN position, that is:—Throttle wide open; Selector or transition lever in full position and Reverser lever in forward position.

4. Blow down main reservoir to zero pressure. Alternate:—Install three-way cock, or side vent cut-out cock in advance of check valve for control air reservoir so that pressure on upstream side of check valve can be reduced to zero by venting through side vent or open outlet of three-way cock, or install pipe tee with plug between cut-out cock and check valve, and reduce pressure on upstream side of check valve by removing plug.

5. Check leakage of control air. If leakage exceeds three (3) pounds per minute, make necessary repairs before proceeding with test.

6. Proceed with test of three reversals of control equipment, starting with controls in the position shown in Item 3. Sequence of operations will be governed by interlocks on controls, functioning of the controls, and presence or absence of transition levers, or separate dynamic or regenerative braking levers. It is important that each control item be operated through three complete reversals, that is:—Throttle or controller handle from full open to idle or off and back to full open, repeated three times. Reverser lever from forward motion to reverse; from reverse to forward; and from forward to reverse. Transition lever, if present, from full position to either off or No. 1 position, depending on interlocks and functioning of contactors. Repeated three times. Dynamic or regenerative brake lever, if present, from full position to off, and back to full; repeated three times.

7. If control air pressure falls to a point where controls fail to operate, it will be necessary to—(1) Provide additional control air reservoir volume, (or) (2) Remove auxiliaries other than controls from control air reservoir and supply auxiliary air direct from main reservoir, preferably from second main reservoir, (or) (3) Increase control air pressure. (Inquire of builders as to maximum permissible control air pressure).

Considerable time will be saved by using one of the alternate methods under Item 4, in preference to reducing the main reservoir pressure to zero. The Committee on Brakes and Brake Equipment recommended the installation of a side vent cut-out cock for this purpose as standard equipment on all new locomotives.

The matter of leakage from the control pressure system is of considerable importance and particularly in cases of small reservoirs requiring an exceptionally high degree of maintenance on the check valves and operating valves on the controls to keep the leakage within safe limits. Such maintenance may prove to be excessive or impracticable in everyday practice. The only solution in this case appears to be an increase in control air reservoir volume. However, in border line cases, proper control of leakage may save the need for a larger reservoir.

Location to Avoid Damage—The requirement of the new rule

—"and shall be so located that it is not readily susceptible to damage," may lead to some difference of opinion as to whether the existing location in individual cases satisfactorily meets the rule. It appears that susceptibility to damage must be tied into the type of accident which would normally result in a locomotive continuing on its way on the track and out of control. To date such accidents have resulted when one or more brake cylinders or brake cylinder pipes have been damaged to the extent that main reservoir pressure is lost through the broken cylinders or pipes. It seems that any location within the body of a locomotive or above the deck should be satisfactory, since any accident of sufficient violence to damage a control reservoir so located, would invariably result in derailment or otherwise halting the progress of the locomotive.

The information collected by the Joint Committee has concerned only the diesel-electric locomotive. The rule however concerns all types of locomotives other than steam and railroads operating straight electric, gasoline electric, or other types, should check such locomotives for compliance with the rule.

MAKING THE SUPPLY OF AIR EFFECTIVE.—It was this phase of the matter which was most difficult to gather information on which was suitable for submission to the railroads because of the variation in practices of the several builders. It was the aim of the joint committee to have all necessary changes to existing equipment be so made that the procedure to be followed by the enginemen in reversing or plugging the traction motors would be the same on all locomotives. It is believed that this has been accomplished. The following outlines the procedure agreed upon:—

PROCEDURE TO STOP LOCOMOTIVES OTHER THAN STEAM IN THE EVENT OF LOSS OF MAIN RESERVOIR PRESSURE.—1. On locomotives equipped with dynamic brakes, proceed to apply dynamic brake as usual. 2. On locomotives not equipped with dynamic brake, or if dynamic brake fails to slow down locomotive:

(a) Move engine throttle to idle position.
(b) On locomotives with manual transition, move transition lever to off position, or to No. 1 position as required by control interlocks and functioning of the contactors.
(c) Move reverser lever to opposite position.
(d) Enginemen to get set for severe retarding action. It should be noted that the action is more severe at lower speeds.
(e) Move throttle lever to position No. 1 only.

Caution—Reversing traction motors to stop a locomotive otherwise out of control is the last resort when all other means have failed. Damage to traction motors and wheels is certain to result if this is necessary at any appreciable speeds. Under no circumstances should reversing traction motors be resorted to as an aid to air brakes. With pressure in the brake cylinders, reversing or plugging the traction motors will resut in sliding of the driving wheels and a net reduction in the retarding effect.

The discussions developed that:

(A) The action of the PC switch, where used, must be such as to have no effect on the main power contactors, or to be so arranged that it would automatically reset so that main contactors will close when the throttle is moved from idle position to position No. 1, the last step of the procedure.

(B) The action of the ground relay must be such as to have no effect on the main power contactors. This is for the reason that when traction motors are reversed under the circumstances under discussion, a flash-over of the motors is very possible, normally resulting in ground relay action, and to insure that such action would not nullify the engineer's effort to stop the locomotive, the ground relay action should not affect the main power contactors.

(C) Some locomotives delivered in the past equipped with dynamic brakes, were so arranged that dynamic braking was effective only in the forward motion. To enable the enginemen to try the dynamic brake, before resorting to reversal of the traction motors, it was agreed that where possible dynamic brakes and controls be arranged so that dynamic brakes would be effective in both directions.

In multiple unit operation, the possibility of having a locomotive unit detach itself from the following unit can be eliminated by locking the couplers between the units, which is entirely permissible on locomotives which are not to be separated enroute by trainmen. It should be definitely understood that it is not permissible to lock the couplers between the locomotive and the train. If this is done, it is necessary that the lock block itself be secured. Any locking device which secures the lock lifter, or the uncoupling rigging will not be effective for this purpose. The report of the Joint Committee shows methods employed by one railroad for the various types of couplers involved. It would be highly desirable to provide protective means for the vulnerable parts such as brake cylinders, brake cylinder pipes, main reservoirs and their attendant piping, to minimize the possibilities of accidents of the type under discussion. In general, the following situation must develop:

(1) The locomotive must suffer damage to the main reservoirs or piping, or to the brake cylinders to cause the loss of main reservoir air pressure; (2) The locomotive or a unit suffering such damage must separate from the train or from succeeding units; and (3) Such locomotive must remain on the track and continue in motion without normal functioning of the air brakes.

The fact that in a number of instances the main reservoir pressure was dissipated through one or more broken brake cylinders or brake cylinder pipes suggests the possibility of introducing suitable stop valves in the brake cylinder lines. These valves would function so as to stop the flow of air in event a brake cylinder or brake cylinder pipe was badly damaged. By suitably segregating the brake cylinders into groups, preferably as between the sides of a locomotive unit, a single valve could protect several brake cylinders. Such arrangements would not only prevent the loss of main reservoir air through the damaged cylinders, but would permit any undamaged cylinders not affected by the stop valve to function as usual.

This matter was discussed but because of the apparent complications, and the number of valves required to furnish complete protection, the matter was not progressed at that time and is not mentioned in the joint committee's report. Complete protection would involve installing such valves for each brake cylinder, and possibly at strategic locations in the brake cylinder lines, and in main reservoir lines. However, partial protection could be provided as mentioned above, and it seems that any device which would definitely prevent the loss of main reservoir air, and have the possibility of having the brake cylinders on even one side of one truck functioning would be preferable to complete loss of the air brake operation.

Locomotive Sanding System

The joint sub-committee from the Signal Section and the Mechanical Division having as its assignment a study of the possible influence of locomotive sanding on track circuit shunt failures, prepared a report including the recommendation that the recommended practice for Locomotive Sanding System in the Manual be reviewed and brought up to date, taking into consideration that every effort must be made to avoid excessive build-up of sand on the rails. Considering that the desired end results are effective sanding for traction and braking without sufficient sand build-up on the rails under any condition to cause a false signal indication, the first approach was a study of the pattern of the sand delivery obtained with the several sizes of sand pipes and diameters of converging nozzles commonly used. Sand traps from three manufacturers were used in the tests and the tests were of sufficient breadth to develop that the pattern of delivery for a given pipe or nozzle size remains approximately the same throughout the range of delivery rate that may be used.

The committee recommended, as a letter ballot proposition, that pages F-238 to F-240 of the Manual be revised in accordance with the following:

Steam Locomotives

Sand pipes to be of 1 in. extra heavy pipe.
Rate of sand delivery per sand pipe per minute:
Engine having one sand delivery per rail, 3 lb. maximum.
Engine having two sand deliveries per rail 1¼ lb. maximum.
Engine having three or more sand deliveries per rail, 1 lb. maximum.

Sand pipe or nozzle to be positioned to deliver the sand to the rail over an area 3 in. to 5 in. ahead of wheel contact with rail through to the point of contact. The delivery to be angled slightly inward to make maximum contact on the inner

half of the rail face having the protection of the wheel flange to reduce the loss.

On drivers equipped with lateral motion device, or lateral cushioning device, sand pipes should be provided with flexible arrangement so that sand pipes can follow drivers when taking curves.

Diesel Locomotives

Sand pipes to be of 1 in. extra heavy pipe.

Rate of sand delivery one pound per minute per sand pipe.

With the sand pipe or nozzle delivery position changing from that when sanding for traction in the brake release position to that when sanding during brake application with fully worn brake shoes extreme care must be exercised in the application of the sand pipe to provide effective sanding for traction and braking. The sand delivery should be into the wheel contact at rail when brakes are set and with fully worn shoes. This results in delivery over an area 3 in. to 5 in. ahead of wheel contact for traction. The high velocity obtained with the ⅝ in. or ½ in. converged nozzles results in a more effective rail conditioning and positive delivery of sand.

It was the opinion of the committee that any complaints regarding excessive sand build-up on rails will be corrected with the exercise of reasonable care regarding a fair quality of sand, preferably to the coarse side of the sieve range of the usual specification for traction sand; sand pipes or nozzles of diameter to provide a high velocity delivery; positioning of delivery nozzles to insure effective delivery of sand to point of wheel rail contact; and maintenance of sand trap adjustment to approximately the recommended delivery rates.

[The report included diagrams for recommended sand pipe location.—EDITOR]

Mounting Control Devices on Journal Boxes

A joint subcommittee has endeavored to adopt a standard method of mounting control devices on journal boxes of both locomotives and cars. In general, the method of mounting control devices on journal boxes shown on Manual page D-4C-1947 is recommended for both locomotives and cars.

The recommendations of the Locomotive Construction Committee are covered by two designs included in the report which were recommended for letter ballot as recommended practice. If approved, they will be included as recommended practice in the Manual.

Standardization of Pedestal Widths

In 1940 the committee undertook a study in an effort to provide standard pedestal arrangements for roller bearing journals for engine trucks, drivers, trailer trucks, and tenders of steam locomotives. The study was subsequently extended to include diesel-electric and electric locomotives. The committee sees no value in continuing any further work on this subject and recommends dropping the matter.

Fusion Welded Boilers

The present status of complete boilers built by the fusion welding process:

Number	Railroad	Type of loco.
1	Delaware & Hudson	2-8-0
2	Canadian Pacific	4-6-2
10	Canadian Pacific	2-8-2
1	New York Central	4-6-4
1	Delaware & Hudson	4-6-6-4
5	Chesapeake & Ohio	2-8-4
10*	Chicago, Milwaukee, St. Paul & Pacific	4-8-4
6	Chicago & North Western	4-6-4

* Seven have been installed and are in service.

In connection with welded shells, present status is as follows:

Three additional welded shells are to be constructed for the New York Central's 6000 Class 4-8-4 type locomotives. There are 27 locomotives of this class in service and when the three shells are completed and applied, all locomotives of the 6000 class will be equipped.

Also, 10 additional welded shells have been constructed and 10 additional are on order for N. Y. C. 4-6-4 type locomotives. When built and applied there will be 40 4-6-4 type locomotives on the New York Central with welded shells.

The Santa Fe has placed orders for a total of 25 welded boiler shells for application to existing boiler back ends of 4-6-4, 4-8-4 and 2-10-4 type locomotives. Sixteen of these shells have been manufactured as of January 29, 1951. Seven have been applied and five are now in the process of application. The installations to date, including those now in process, are as follows:

No. of welded shells applied	Type of locomotive
1	4-6-4
7	4-8-4
4	2-10-4

It will be noted that since the previous report, 34 additional boiler shells have been ordered.

Seal Welding of Staybolts

An item was included in the 1950 report indicating that the practice of seal welding staybolts has been sufficiently extended to warrant adoption as recommended practice. Therefore, a drawing has been prepared and it is recommended, as a letter ballot proposition, for adoption as recommended practice for inclusion in the Manual.

Axle Press Fits

The present recommended practice covering mounting pressures for driving, trailing, and engine truck axles, and crank pins, shown on pages F-129-1932 and F-130-1932 of the Manual, is not applicable to prestressed bores and rolled wheel fits. The Committee on Axle and Crank Pin Research has developed the procedure for making such fits and has included suitable mounting pressures. It is recommended, as a letter ballot proposition, that this procedure be adopted as recommended practice.

Two drawings, in the report, outline the recommendations.

Steam Locomotive Storage

Standard instructions covering the detailed procedure to be followed in placing locomotives in storage and covering their care while in storage have been obtained from 26 representative railroads. This information has been analyzed and is covered in detail in the report.

Diesel-Electric Locomotives

Recently the committee has been in contact, with the Locomotive Maintenance Officers' Association with the idea of preparing a list of practices and materials of diesel-electric locomotives that can be standardized. This organization is now preparing such a list, which will be submitted to the committee for study.

CAB ARRANGEMENT, SWITCHING LOCOMOTIVES—The locomotive builders have submitted scores of blue prints covering the cab arrangement on the different types of switching locomotives now in service. The committee feels that these prints bear out the need of arriving at a standard location for the brake valve, engine throttle, and other controls.

A questionnaire has been prepared with a diagram including proposed dimensions of pertinent details concerning the cab arrangement on diesel-electric switching locomotives. The secretary has arranged to submit this questionnaire and diagram to the regular list of 32 principal roads, to determine if it will be consistently possible to recommend standardization of the general arrangement of cab equipment.

BOLTS FOR ROLLER BEARING BOXES—Rapid dieselization has introduced many different types and sizes of journal box stud and cap bolts. Where it is necessary to remove and reapply cap screws for regular inspection and maintenance of roller bearing boxes, it has been costly and inconvenient to maintain a considerable number of wrenches of different sizes. The committee has been in contact with the manufacturers with the view of providing the least number of different kinds of cap screws consistent with journal box design.

STANDARDIZATION OF AIR BRAKE EQUIPMENT—The committee reported progress on this item. It is felt that one of the benefits of investigation will be the prevention of any additional non-standard arrangements being developed by the builders.

At present it has been agreed by the brake committee and the Locomotive Construction Committee that a joint meeting should be held with the locomotive builders and the air brake manufacturers to discuss the following:

FIRE-EXTINGUISHER EQUIPMENT—DIESEL-ELECTRIC LOCOMOTIVES

Railroad	Locomotive Service	Unit	Cab: Carbon tetrachloride qt. 1	1½	2	4	Cab: Carbon dioxide lb. 15	20	50	Cab: Dry powder lb. 20	30	Engine room or compartment: Carbon tetrachloride qt. 1	1½	2	4	Engine room or compartment: Carbon dioxide lb. 15	20	50	Engine room or compartment: Dry powder lb. 20	30
Baltimore & Ohio	Road	A	1														4			
		B															5			
Chesapeake & Ohio	Switch																			
	Present			1									1							
	New							1									1			
New York Central	Switch										1									2
	Road	A									1									4
		B																		4
New York, New Haven & Hartford	Switch;																			
	Old			1			1													
	Old alternate					1		1												
	New										2									
	Road:																			
	Two engines														3			1		
	Road:																			
	Single engine	A				1												2		
		B													1			2		
	Road switch:																			
	44 ton		1				1													
	1,500 hp																			
	Old					1	1													
	New										2									
Southern Pacific	Switch					1									1					
	Alternate							1												
	Road:																			
	Two engines	A			1										2		3			
		B													2		4			
	Road:																			
	Single engine	A			1										2		4			
		B													2		4			
	Road switch;																			
	44 ton							1												
	Large					1											2			
Canadian National	Switch					1									1					
	Alternate		1																	1
	Road:	A	1												1					
		B													1					
St. Louis-San Francisco	Switch					1				1										
	Road:																			
	Two engines		1												2					2
	Single	A	1												1					2
		B													1					2
	Road switch:																			
	1,500 hp.		1								1									
Union Pacific	Switch					1									1					
	Road:																			
	Passenger																4			2
	Freight																4			2
	Freight alternate														1		3			
	Road switch										1				1		1			
Atchison, Topeka & Santa Fe	Switch					1									1					
	Road:																			
	Two engines				1										1					2
	Single engine	A				1									1					2
		B													1					2
Pennsylvania	Switch							1									1			
	Road	A									1							4		1
		B																4		2
Chicago, Milwaukee, St. Paul & Pacific	Switch					1		1												
	Road	A	1												1		1	1		
		B													1		1	1		
	Road switch					1		1												

1. Safety control
2. Locomotive overspeed control
3. Split reduction with overspeed or safety control
4. Break-in-two protection
5. Sanding bail on automatic brake valve
6. Controlled emergency brake cylinder build-up
7. Location of parts for maintenance
8. Studs instead of cap screws
9. Dynamic interlock
10. Standard plug connectors for electropneumatic brake circuits
11. Standard hose and couplings for air connections
12. Extra heavy pipe
13. Air gages
14. Slow charging of equalizing reservoir with D24 brake valve
15. Governor synchronization
16. Radiation and cooling of compressor air
17. Angle cocks
18. Booster unit
19. Brake-cylinder gage pipe

FIRE PROTECTIVE EQUIPMENT—Investigation of fire prevention by the committee has been carried out in cooperation with the Fire Protection and Insurance Section. It is evident that the greatest fire protection available is the maintaining of general cleanliness in and about the locomotive. This problem includes oil leaks from the engines, fuel tank, steam generators and their appurtenances, and grease leakage on traction motor gear cases. Too much stress cannot be placed on the elimination of all oil leaks, and the manufacturers must always strive for the better joints at all points on the diesel engines and accessories. Better gaskets should be forthcoming with the availability of modern materials.

The cleaning of diesel locomotives, both interior and exterior, is a major problem of both maintenance and cost. The locomotive builders should make every effort to provide an arrangement that will present the smoothest contour possible, both inside and under the locomotive. This will permit easy cleaning with modern spray equipment and cleaning materials that are now available. As a result of the locomotive design, much difficulty is being encountered in using this modern spray equipment. In many cases it is necessary to perform this cleaning by hand.

Several types of fire extinguishers with their different extinguisher media are being studied in cooperation with the Fire Protection and Insurance Section. The table shows fire extinguisher equipment in use.

MOUNTING PRESSURES FOR STEEL WHEELS—It has been found desirable to provide a recommended practice to cover suitable pressure for mounting wrought steel wheels on gear driven and idler axles on locomotives. The matter was considered by a joint committee of members of the Committee on Wheels and the Committee on Locomotive Construction, and it is recommended that the table below be submitted to letter ballot as recommended practice for inclusion as new page in Section F of the Manual.

MOUNTING PRESSURES FOR WROUGHT STEEL WHEELS ON GEAR-DRIVEN AND IDLER AXLES OF LOCOMOTIVES OTHER THAN STEAM

Diameter of wheel seat (in.)	Mounting pressures (tons) Minimum	Desired	Maximum
6.000 to 6.250, inclusive	75	80	95
6.375 to 6.625, inclusive	75	85	100
6.750 to 7.000, inclusive	75	90	110
7.125 to 7.375, inclusive	75	95	115
7.500 to 7.875, inclusive	80	100	120
8.000 to 8.250, inclusive	85	105	125
8.375 to 8.625, inclusive	90	110	130
8.750 to 9.000, inclusive	90	115	140
9,125 to 9,375, inclusive	95	120	145
9.500 to 9.750, inclusive	100	125	150
9.875 to 10.125, inclusive	105	130	155
10.250 to 10.500, inclusive	110	135	160
10.625 to 10.875, inclusive	110	140	170
11.000 to 11.250, inclusive	115	145	175
11.375 to 11.625, inclusive	120	150	180
11.750 to 12.000, inclusive	125	155	185
12.125 to 12.375, inclusive	130	160	190
12.500 to 12.750, inclusive	130	165	200
12.875 to 13.250, inclusive	135	170	205
13.375 to 13.625, inclusive	140	175	210
13.750 to 14.000, inclusive	145	180	215

Desired mounting pressures are based on 13 tons per inch of diameter, expressed in the nearest 5 tons with an allowable variation of 20 per cent over and under, except the first three minimum pressure which are shown as 75 tons, being considered better practice for these sizes.

OVERHEATING OF MOTOR BEARINGS—As stated in the report last year, all known devices that will furnish any degree of protection or alarm for an overheated suspension bearing or traction motor armature shaft bearing have been considered. Experience with available thermal type alarms does not justify any recommendation on their use for this purpose at this time. The danger from an overheated traction motor armature bearing is when the rotation of the wheel is interrupted. There are three known appurtenances that can be used to give indication of the interruption of the rotation of the wheel, and some of each are on test and are being followed by the committee. It appears that some of these devices can also be utilized to give a better wheel slip control than is now afforded by present devices in common use.

The warning given in last year's report is again repeated —Railroads should make certain that all employees understand the significance of repeated wheel slip indications, and repeated ground relay actions while en route; emphasizing the need for inspection of the diesel locomotive for possible sliding of wheels when such repeated warnings are given by these devices. Such inspection must be made before the affected power plant is shut down.

The report included lengthy discussions of two broad subjects, one the combustion of coal and the other gas turbine development. The coal combustion discussion outlines a series of tests and investigations on several roads with the idea of recording the relation of steam locomotive devices and their application to the efficiency of fuel combustion and gave the results of tests run by the Standard Stoker Company and the Pittsburgh Coal Company.

The discussion of gas turbines was in the nature of progress reports on the General Electric, Westinghouse and Baldwin-Lima-Hamilton locomotives and the coal-burning gas-turbine development of the Bituminous Coal Research group. Most of the information in this section of the report is already a matter of record.

The members of the committee were A. G. Hoppe (chairman), engineer research and development, Milwaukee.

Steam and Electric Locomotive Section: C. H. Knowlton (vice-chairman), assistant engineer equipment, New York Central; H. C. Wright, general superintendent motive power, Pennsylvania; G. M. Harding, assistant chief mechanical engineer, Canadian National; H. H. Lanning; and J. L. Ryan, mechanical engineer, Frisco.

Diesel Locomotive Section: G. F. Wiles (vice-chairman), supervisor diesel-electric locomotive operation, Baltimore & Ohio; K. Cartwright, general mechanical superintendent, New Haven; H. V. Gill, superintendent shops, Santa Fe; F. Thomas, assistant to general superintendent equipment, diesel and electric, New York Central; and D. R. Calleri, mechanical engineer, Southern Pacific.

Gas Turbine Locomotive Section: H. C. Wyatt (vice-chairman), assistant general superintendent motive power, Norfolk & Western; E. R. Hauer, assistant superintendent motive power, engineering, mechanical, Chesapeake & Ohio; J. L. Caver, mechanical and research engineer, Illinois Central; H. Rees, mechanical engineer, Union Pacific; and F. H. Einwaechter, chief engineer, motive power and equipment, Baltimore & Ohio.

The report was (with one amendment) accepted and referred to letter ballot.

Specifications for Materials

The committee made recommendations on the following specification changes:

M-101 (carbon-steel axles, as forged) to increase the permissible run out of the center of the axle from ¼ in. to ⅜ in. as an emergency measure, and two other changes to be submitted to letter ballot.

M-105 (blooms, billets and slabs for forgings) to be separated by the committee during the coming year into two specifications, M-105 to cover carbon steel and M-131 to cover alloy steel.

M-106 (steel tires, locomotives and cars) to conform to present commercial practice.

M-107 (multiple-wear wrought carbon-steel wheels) to meet changed conditions of service and present mill heat-present commercial practice.

M-108 (boiler tubes) deleted because product covered is no longer made.

M-110 (rivet steel and rivets) editorial changes.

M-111 (pipe for special purposes) and M-114 (carbon-steel helical springs) to be consistent with commercial practices.

M-115 (boiler and firebox steel) is under consideration for revision to decide if the copper restriction should be deleted from the base specifications and included as a supplementary requirement.

M-118 (coupler knuckle pivot and swivel pins) to meet currently accepted standard practices and to avoid paying extra for special chemical requirements.

M-120 (journal-box lids) to include specifications for 6½ in. by 12-in. journal-box lids.

M-124 (heat-treated steel tires) and M-130 (pipe for ordinary uses) to meet present commercial practice.

M-403 (malleable iron castings) to include three changes in identification marks.

M-502 (relined journal bearings) to set up the same tolerances for new and relined bearings, thus requiring only one set of inspection gages.

M-601 (air-brake and train-air-signal hose), M-603 (cutting and welding hose), M-605 (steam and hot-water hose), and M-608 (air-pneumatic tool hose) to permit the use of synthetic rubber.

M-904 (renovated car oil), M-905 (new waste for journal-box packing), M-906 (new car oil), and M-910 (renovated journal-box packing) as emergency specifications to supersede present A.A.R. specifications until the research now being conducted is completed in order to keep hot boxes at a minimum.

M-911 (bristle, hair, fiber and wire brushes) and M-195 (nylon filament brushes)—a revision is under consideration as an emergency specification.

M-916 (car and locomotive sand) to include new specifications for car and locomotive sand.

The above changes, with the exception of emergency measures and editorial revisions, were recommended for submission to letter ballot.

General

A study of diesel crankcase lubricants and fuel proposed in the 1950 report was considered at a meeting of the Committee on Research, and it was decided that the subject should be progressed.

The proposal in the 1950 report that requirements for winter thinner or cut-back oil for journal boxes he added to M-906-New Car Oil was rejected in favor of formulating new specifications covering suitable oil for this purpose. This was assigned to a subcommittee which submitted a draft of specifications to the

major oil refineries to solicit comments and suggestions. The replies indicated that the specifications submitted would greatly limit the source for such an oil.

The proposed specifications were submitted to J. R. Jackson for review on the basis of facts developed at the Indianapolis laboratory. Tests there indicated that no appreciable benefit is derived from mixing cutback oils with ordinary renovated oil to prevent journal-box packing from rolling or being displaced on starts in subzero weather, and that blending oils and procedure requiring technical control should be done in a properly equipped and supervised blending plant.

It was suggested that, before any specifications for cold-weather journal swabbing oil are adopted, samples of the proposed oils be sent to the Indianapolis laboratory for comparative tests under extreme subzero temperature conditions. These particular tests will include other materials besides the oils mentioned, such as isopropyl alcohol, distillate fuel oil and kerosene. While these materials are prohibited under present A.A.R. rules it is believed that their effectiveness as swabbing material should be established for judicious use as they appear to be the only effective treatment under extreme subzero operating conditions.

Members of the committee are W. F. Collins (chairman), engineer of tests, New York Central; P. H. Smith (vice-chairman), engineer of tests, Burlington; H. G. Burnham, engineer of tests, Northern Pacific; M. A. Pinney, engineer of tests, Pennsylvania; Frank Fahland, research and standards engineer, Union Pacific; R. W. Seniff, engineer of tests, Baltimore & Ohio; E. B. Fields, engineer of tests, Santa Fe; R. McBrian, engineer standards and research, Denver & Rio Grande Western; L. S. Crane, engineer of tests, Southern; G. E. Baumgardner, assistant research engineer, Norfolk & Western; V. C. Barth, chief chemist, Chicago & North Western.

Discussion

It was asked if the A.A.R. has any provisions for remedying cold-weather starting during the interim period while a cold-weather journal-box oil is being developed. The answer was that tests have shown that thinner oil does no good—the original characteristics of the oil were retained. The packing rolled even when the oil was cut with kerosene. The tests were made without packing retainers.

Tests run by a railroad at from 35 to 50 below showed that retainers would reduce but not eliminate rolling.

One member pointed out that on the Northern Pacific the hot-box problem is at its worst in July and August.

Since the report was printed two requests for cerificates of approval have been received for 6½-in. by 11-in. journal-box lids.

(*The report was accepted and referred to letter ballot.*)

Arbitration

During the year Cases 1834 to 1836, inclusive, have been decided and copies forwarded to the members.

The following principal changes are recommended:

With the concurrence of the Committee on Couplers and Draft Gears, modification of the third note following Paragraph (d-1) of Rule 3 to provide specific reference to short draft gears approved for cars of special construction.

With the concurrence of the Car Construction Committee, modification of Paragraph (r-1) of Rule 3, to indicate that means of holding sliding type doors on refrigerator cars open is not required.

Modification of Paragraph (k-2) of Rule 4, to indicate that road issuing defect card may, at its own discretion, also issue additional defect card for unconcealed associated unfair usage defects when so requested by car owner.

With the concurrence of the Wheels Committee, modification of Rules 9, 10, 70, 82, 98 and 101 to establish a more equitable basis for charges and credits for one-wear wrought-steel wheels reclaimed by turning, and to avoid the necessity for following such wheels through the wheel shops to complete billing transactions.

Elimination of last paragraph and note following of Rule 16, to make the testing of safety valves on tank cars unnecessary by member roads.

With the concurrence of the Tank Car Committee, modification of Interpretation No. 1 of Rule 16, to insure proper patching of tanks of tank cars.

Modification of Notes 2 and 3 following Section (e) of Rule 17, to provide car owner proper protection for sliding chair castings when A.A.R. Standard No. 18 beams are applied.

Elimination of first notes following Sections (g) and (1), and the addition of new note following Rule 60; and modification of Paragraph (j-2) of Passenger Rule 7, to indicate definite requirements in connection with periodic attention to air brakes and to provide reference to air-brake pamphlets governing such work.

With the concurrence of the Lubrication Committee, elimination of note following present Section (k) and addition of new Section (k) of Rule 66-A, to indicate types of greases approved for lubrication of journal roller bearings; also modification of the last paragraph of Rule 85 to provide a one-month period of grace whereby handling line can return cars equipped with journal roller bearings to the owner in order to avoid responsibility for failure because of lubrication date being overdue.

Modification of Paragraph (1-b-3) of Section A of Rule 112, to clarify the intent with respect to transportation charges on damaged cars returned to owner.

Addition of new note following Section (h) of Passenger Rule 2 to expedite the installation of A.A.R. Standard passenger car axles to passenger equipment cars.

The committee did not feel that any of the modifications included in its report necessitated submission to letter ballot.

Members of the committee are J. A. Deppe (chairman), superintendent car department, Milwaukee; W. N. Messimer (vice-chairman), general superintendent of equipment, Merchants Despatch Transportation Corporation; H. M. Wood, assistant chief of motive power (car), Pennsylvania; R. M. Smith, vice-president, Union Tank Car Company; R. E. Baker, assistant general manager (mechanical), Boston & Maine; R. D. Bryan, mechanical assistant, Santa Fe; A. H. Gaebler, superintendent car department, General American Transportation Corporation; E. P. Stemshorn, assistant chief of car equipment, Canadian National.

(*The report was accepted.*)

Couplers and Draft Gears

Couplers

Shank Wear Plates.—Proposed regulations covering the application of wear plates on coupler shanks, recommended by the Mechanical Committee of the Standard Coupler Manufacturers, have been approved by the committee as a letter ballot item.

Diesel Coupler Standardization.—The committee found more than 80 different coupler designs on diesel locomotives. Slight variations in the designs effectively prevented inter-changing couplers and because of the resulting maintenance problems and high cost the committee recommends that eleven designs, Fig. 1, selected by various railroads and the coupler manufacturers be submitted to letter ballot for adoption as alternate standards. The eleven designs were selected because they seem to meet the main differences in underframe designs of the locomotive builders. The committee believes new diesel locomotives should be designed to use only these alternate standards. Approval of the recommendation will not prevent the continued use and replacement in kind of all existing couplers on locomotives now in service.

Coupler Specifications Revisions.—The revisions of Specifications M-204-49 and M-206-49 covering the purchase and acceptance of Types E and H Couplers, respectively, are recommended as letter ballot items. The revisions, included as Exhibits B and C of the report, make the specifications consistent with the recommended welding procedure for high tensile steel castings as it affects coupler castings.

Coupler Reclamation (Types D and E).—With a decision made on the welding of high tensile steel castings the committee recommends, as a letter ballot item, the revision to Pages C-66 to C-72, inclusive of Appendix A, Section C of the Manual to incorporate provisions for reclaiming high tensile steel Type E coupler bodies. The proposed revisions were included as Exhibit D of the report.

Improved Coupler Operating Rod.—An improved coupler oper-

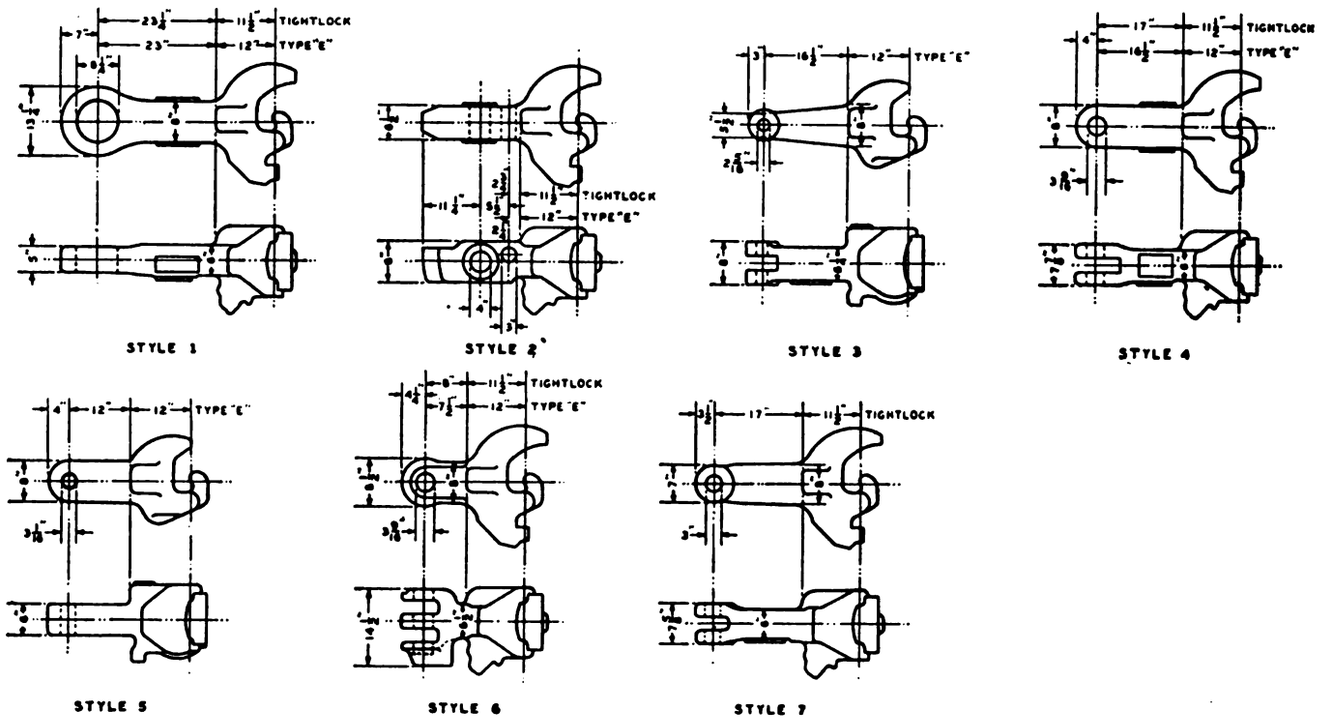


Fig. 1—Eleven coupler designs selected as alternate standards for diesel locomotives. Note that four of the styles show dimensions for both tightlock and Type E couplers.

ating rod developed by the Standard Railway Equipment Manufacturing Company, is suitable for use with either the Type E coupler or the Type F interlocking coupler on freight cars. The rod is the same as the present standard rod except that the lower portion of the handle has an inwardly extended hand grip. Maximum leverage is obtained and the handle is in a better position to fully open the knuckle. The committee, with the concurrence of the Mechanical Committee of the Standard Coupler Manufacturers, recommends letter ballot approval of this item as an alternate standard.

Pitt Type Coupler.—Due to failures in service and inherent weakness of design the committee recommends, as a letter ballot item, that the Interchange Rules be revised to include the rule that cars equipped with Pitt type couplers shall not be acceptable in interchange after January 1, 1955.

Type F Interlocking Coupler.—Ten cars were equipped with Type F interlocking couplers for freight equipment during the past year. Their performance in eight months of service was entirely satisfactory; the same is true of six cars sets in service for approximately three years. An additional 43 cars are now being equipped with Type F Couplers. Because of the satisfactory record the committee has authorized an increase in trial service applications from 250 to 5,000 car sets. A new circular No. 5550 describing and illustrating the important features and advantages of the Type F coupler may be obtained from any of the standard coupler manufacturers.

Standard H Tightlock Coupler.—Because the outstanding advantages of the Standard H tightlock coupler are widely recognized the committee recommends for letter ballot that this coupler be made mandatory for all passenger equipment cars built new on or after January 1, 1953.

An improvement in the design of the guard of this coupler to resist vertical distortion has been approved for incorporation in the manufacturers' equipment as soon as practicable. Also, as a result of the vertical distortion occurring with tightlock couplers it was apparent that the vertical distance between the guard arm and the aligning wing pocket opening should be increased. A change in the manufacturers' drawbar face and contour gage No. 31707 has been approved to provide a ⅛-in. minimum difference between the gage dimensions and the corresponding opening in the wing pocket.

Undesired emergency brake applications in freight trains hauled by diesel locomotives equipped with tightlock couplers have been caused by interference of the lower interlocking lug on the aligning wing pocket with the air hose on the freight car. To eliminate this condition instructions have been issued to the members on the procedure and details for modifying new and existing Type H couplers. The modifications to existing Type H couplers are shown in Fig. 2. Manufacturers have been authorized to incorporate the changes in new coupler production as soon as practicable.

Standard Yoke Tolerances.—To establish uniformly consistent control of the important dimensions of standard yokes the Mechanical Committee of the Standard Coupler Manufacturers proposed that tolerances be shown on the yoke drawings in the Manual. New drawings to replace those shown on Pages C-38-A to C-38-D were included in the report and will be shown in the manual. Plate 321 in the Supplement to the Manual shows an obsolete design of the Grade B steel Y-40 yoke and the committee recommends its deletion.

Derailments of Cars Equipped with Swivel Shank or Swivel Butt Couplers.—The special subcommittee has completed its report covering the results of its studies of derailments on the Pennsylvania of empty cars equipped with swivel shank couplers and swivel yokes, or with swivel shank couplers with swivel butts and Farlow two-key yokes, when the cars are used in heavy pusher service. After thoroughly reviewing and discussing the results of extensive tests conducted by the committee and supplemental tests conducted by the Pennsylvania the committee recommends the elimination of the swivel butt coupler with horizontal yoke and two keys as an alternate standard. This action will involve the elimination of the swivel butt casting No. Y-20 from Page C-32-A of the Manual. It is recommended for approval by letter ballot, effective December 31, 1951.

Draft Gears

Certified Draft Gears.—A certificate of approval was granted during the past year to a gear submitted by the American Steel Foundries but to be designated as the Peerless Quad type draft gear and sold by the Peerless Equipment Company. A rubber draft gear known as the National Type M-260, submitted by the National Malleable and Steel Castings Company, is now being tested to the new tentative specifications for rubber draft gears for freight service.

Short Draft Gears.—The short draft gears for cars of special

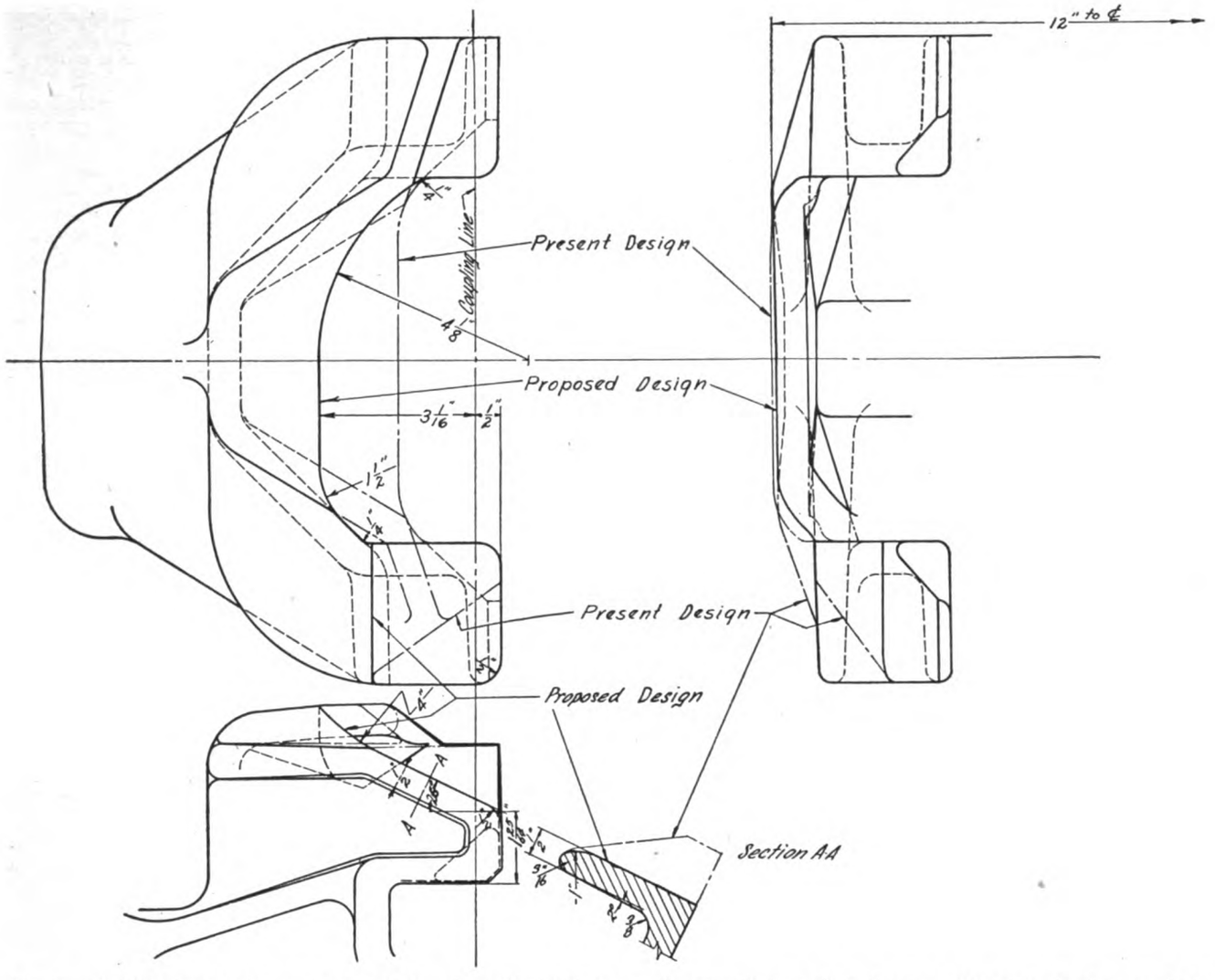


Fig. 2—Modifications to be made to existing Type H tightlock couplers to eliminate interference with air brake hose and the resulting emergency brake applications. These brake applications have been reported in freight trains hauled by diesel locomotives equipped with tightlock couplers.

construction approved to date are: Miner A-69-XB, Miner A-100-D, Cardwell V-18 and Cardwell L-11-S.

Check Tests of Certified Canadian Gears.—The tests of this group of gears have been completed and the results supplied to the manufacturers and the Canadian member roads.

Check Tests After Service.—Check tests of certified draft gears after 5 and 12 years of service have been completed except for the National M-50-B gear, specimens of which have not yet been found.

Waugh Twin-Cushion Tests.—Four specimens of the Waugh Twin-Cushion Type WM-4-6 gear, made of synthetic rubber, were tested after five years of service with an average of 134,000 miles of service. The gears were found in good condition and their capacity and performance were practically the same as when tested new, prior to application.

Waugh Twin-Cushion Type-4-6R Gear.—The application of 500 cars sets of this gear has been authorized for experimental service. It is a modification of the Waughmat Twin-Cushion Type WM-4-6 with a yoke designed for use with rigid shank couplers.

Check Tests of Conditional Gears.—Three conditionally approved gears, the Miner A-22-XL, Hulson 202 and the Waugh-Gould 420, have had two years of service in substantial numbers. Arrangements are being made for check tests and if results are satisfactory gears will be eligible for unconditional approval.

Draft Gear Reaction Measurements.—To find a better and simpler method of measuring draft gear reaction, extensive tests have been made at the A.A.R. Laboratory, Purdue University. Tests have been made on eight types of gears using SR-4 strain gages, a cathode ray oscillograph and a rotating drum camera, as well as the standard chronograph. Before it can be determined that the oscillograph records have practical value it is believed that impact tests will have to be made and such tests are under consideration.

Specifications for Rubber Draft Gears.—Tentative specifications covering draft gears of the rubber cushion type, included in the report, were submitted by the committee but they are not recommended for adoption as standard at this time. The tentative specifications are the same as those established for metallic type gears. (Specifications M-901) except for modifications necessary to make them applicable to rubber gears.

The members of the committee are H. W. Faus, (Chairman), engineer, locomotive equipment, N. Y. C.; C. K. Steins (vice-chairman), mechanical engineer, P. R. R.; F. T. James, general superintendent motive power and equipment, D., L. & W.; B. Faughnan, assistant works manager Angus shops, Can. Pac., J. W. Hawthorne, general superintendent motive power and equipment, A. C. L.; I. N. Moseley, research and test engineer, N. & W.; A. W. Maydahl, engineer car maintenance, U. P.; A. B. Lawson, mechanical engineer, B. & O., and N. A. Passur, engineer car construction, S. P.

Discussion

Several members commented at length, concerning the difficulties that many roads are having with trains breaking in two

due to the malfunctioning of the uncoupling rigging on certain types of bottom-operated couplers in both freight and passenger service. Those who discussed the subject presented the details of conditions surrounding several specific cases and the results of investigations that had been made to determine the causes. While recommendations were not made as to the manner of correcting the difficulties the general opinion was that the committee should instigate a study of the entire situation both with respect to possible changes in uncoupling arrangements and the effects of wear of coupler and rigging parts.

(The report was accepted and referred to letter ballot.)

Loading Rules

The first part of this report included general statements concerning the work of the committee with respect to loading military equipment, and in connection with the publications of the rules in pamphlet form.

With the opening of hostilities in Korea, the Army-Navy Special Supplement No. 1, covering the loading of mechanized and motorized equipment and major caliber guns, accompanied by and under direct supervision of military personnel, was reissued October 1950, at the request of the railroads and the Department of Defense. The Army-Navy Special Supplement No. 2, covering the loading of military vehicles and major caliber guns not transported in complete trains or accompanied by department of defense personnel, was issued in January 1951. This supplement, which was revised in joint agreement with the Loading Rules Committee of the Military Traffic Service, Department of Defense, contains figures and specifications for all new equipment which has been brought to the attention of the Loading Rules Committee.

Sponsored by the Military Traffic Service of the Department of Defense and conducted jointly by the Departments of the Army, Navy, and Air Force and the A.A.R., a series of three-day seminars on sound loading and bracing methods to prevent loss or damage to vital equipment and war material, have just recently been completed. The seminars were developed by the Loading Rules Committee of the Military Traffic Service under the chairmanship of Francis X. Dunleavy, assistant deputy director of military traffic service, in coordination with the A.A.R.

At the request of the Ordnance Department of the U. S. Army, a member of the Loading Rules Committee and representative of the Freight Loading and Container Section of the A.A.R. made visits to the Rossford Ordnance Depot, Toledo, Ohio, to present a program on open and closed car loading at their school on packaging, bracing and blocking. This matter has now been delegated to two representatives of the depot who were given instructions on both open and closed carloading by members of the committee and the Freight Loading and Container Section.

As stated at the 1950 meeting, all publications of the Loading Rules will be in pamphlet form. The following pamphlets have been issued to date: Grading and Road Making Machinery; Steel Products, excluding Pipe; Machinery; Pipe; and Miscellaneous Commodities.

All forest products have been included in a separate pamphlet recently issued by the Special Committee on Forest Products Loading.

Difficulties experienced on shipments of tractors, particularly the cross-wise loading method, has resulted in recommendations for improvements in methods for loading tractors. These recommendations have now been sent to the Farm Equipment Institute for concurrence and will be included in the pamphlet covering Farm Equipment Machinery, if approved. The balance of the figures to be included in this pamphlet are now being prepared by the subcommittee. Several joint meetings have been held with the Farm Equipment Institute to progress the preparation of the specifications and drawings of the farm machinery to be included in this pamphlet. It is expected that the approved figures can be selected at the next joint meeting and placed in line for publication, which will complete the division of the present Loading Rules in pamphlet form.

The detailed recommendations in the report consisted of (1) completed items scheduled for early inclusion in the rules and (2) subjects still under consideration. The first group of items concerned revisions of rule 15 and Figs. 8-A, MD-1; 45, MD-1; 45A, MD-1; 171 and 172A, which changes were made at the request of shippers, while changes were made in Figs. 12, MD-1; 30, MD-1 and 44, MD-1 to clarify the intent of the rule. A new paragraph was added to Fig. 60, MD-1 concerning turntables more than 50 ft. in length to provide for greater safety.

In the second group there are approximately 17 subjects still under consideration, some of which will require only revision in the present specifications and figures, while others will require the formulation of new specifications and figures to cover. The subjects embrace nine on steel products (coils; plates; sheets; slabs; tanks) two on farm machinery (preparation of farm equipment machinery pamphlet; tractors); four on stone and clay products; (stone; marble; pouring channels; sewer pipe); one on machinery (cranes) and one on Army-Navy material (engines).

Inspections have been made and experimental shipments are being forwarded, and other experimental tests considered, on loading methods for steel products, the results of which will determine their inclusion in the rules.

Progress has been reported by the subcommittees on the loading methods under consideration for stone, sewer pipe, pouring channels and cranes, all of which require inspection at the shippers' plants. These inspections are now being held, and the loading methods progressed for inclusion in the rules.

The experimental shipments of jet engines in metal containers, cradled and secured on flat cars, having proved satisfactory, specifications and drawings are being prepared by the subcommittee for inclusion in the Army-Navy Supplement No. 2.

The members of the Loading Rules Committee are: W. B. Moir (chairman) chief car inspector, Pennsylvania; H. H. Golden (vice-chairman), supervisor A.A.R. interchange and accounting, Louisville & Nashville; T. W. Carr, assistant to superintendent of equipment, Pittsburgh & Lake Erie; A. H. Keys, superintendent car department, Baltimore & Ohio; H. S. Keppelman, superintendent car department, Reading; F. A. Shoulty, assistant superintendent car department, Milwaukee; H. J. Oliver, assistant superintendent motive power, Detroit, Toledo & Ironton; G. R. Andersen, superintendent car department, Chicago & North Western; H. L. Hewing, superintendent of interchange, Chicago Car Interchange Bureau; N. A. Williams, assistant engineer freight car design, Union Pacific; L. F. Delventhal, Jr., transportation inspector, Western Pacific; and J. H. Campbell, supervisor of loading, Mechanical Division, A.A.R.

Forest Products Loading

Since the last meeting, the Special Committee on Lumber Loading has been renamed the Special Committee on Forest Products Loading. Due to the apparent necessity of including in the rules a figure to cover an economical method of loading lumber, new Fig. 6-C has been formulated. This figure covers the loading of packaged or bundled lumber 10 ft. to 16 ft. in length on flat or gondola cars and employs the best features of the various methods submitted to the committee by the shippers. It was felt that shipments loaded under this figure would materially decrease the present number of disarranged packaged lumber loads.

The following changes were approved for inclusion in the rules:

(1) The use of common wire of other gages for that specified, provided they are of equivalent load strength. This change was approved because of the present scarcity of No. 9 gage common annealed wire.

(2) The permission to load vertical pieces to a height of 5 ft. 6 in. above top of car sides in Fig. 22, to permit shippers to load 10 ft. ties vertically in gondola cars with 54 in. sides.

(3) The clarification of the second sentence of the paragraph covering gondola cars for Item B of Fig. 26 as follows: "Not required when logs in top layer adjacent to car sides extend ⅓ or more below top of car sides, and when logs between those against car sides extend 4 in. or more below top of car sides or ends."

These changes and new Fig. 6-C were included in the new Forest Products Pamphlet which has now been issued as No. MD-3, and covers the loading of all forest products.

The members of this committee, in addition to the personnel of the Loading Rules Committee, are: F. A. Shoulty (chairman), assistant superintendent car department, Milwaukee; F. G. Moody

(vice-chairman), superintendent car department, Northern Pacific; G. J. Lehnerer, superintendent car department, Illinois Central; and L. E. Day, district master car repairer, Southern Pacific.

Discussion

Harry D. Fenske, assistant vice-president, Great Lakes Steel Corporation, a unit of the National Steel Corporation, in commenting on the close cooperation which exists between the Committee on Loading Rules of the Mechanical Division and the various groups of shippers, said that in these highly competitive times in the transportation field such cooperation was an important accomplishment. He urged that it be extended even further. The great need to be filled, he said, is a better way to get freight to and from the place where the shipper wants it before and after it is moved in trainload lots. Mechanical officers, he thought, had much to contribute in the development of types of equipment most likely to meet this need. An effective method of making special types of cars for special lading carry revenue loads in every direction has not yet been found. This he presented as one of the problems in which cooperative effort might prove effective.

(The report was accepted.)

Wheels

The introduction to this report outlined the changes in the Wheel and Axle Manual and included in the new printing dated February 1951 and now available. A modification of Paragraph 305 of this new manual has been made, as follows: "New unmounted wheels with ground treads should have the final tape size, measured after grinding, preceded by the letter G, stenciled with white lead paint on front and back of plate, and the tape markings cast on the wheel chipped to show the original as-cast tape size."

In this connection recommendation was made to the Committee on Specifications for Materials that Section 6 (d) of Specifications M-403 be revised to coincide with Paragraph 305 of the Wheel and Axle Manual.

The committee recommended certain changes in Par. 5, Sec. 4, Specification M-403.

Recommendations were made, as a letter ballot item, that designs for cast iron wheels, Manual page G-2A-1950 for Axle B and G-2B-1950 for Axles C to E inclusive, be advanced from "Recommended Practice" to "Standard."

It was also recommended, as a letter ballot item, that the nominal weight of 850-lb. single plate bracketed cast iron wheel (cored hub and alternate solid hub designs) shown on page G-2B-1950 of the Manual be reduced to 835 lb. without change in dimensions and, if adopted, necessary corrections be made in A.A.R. Specifications M-403—Cast Iron Wheels.

Cast Iron Wheel Failures

As information, data concerning cast iron wheel failures reported to the Interstate Commerce Commission for the average of five years previous to 1950, and the year 1949, compared with 1950 where damage was over $275 showed the following:

1945-49, incl. (Avg.)	Total	Flange	Plate	Rim
1949	281	175	59	47
1950	174	140	30	4
Year	220	170	37	13

Specifications M-103 and M-107

Due to the fact these specifications do not contain sufficient specific information with respect to standard and temporary standard designs of wrought steel wheels, the committee requested the committee on Specifications for Materials to modify Sections 2—Design of Specifications M-103 and M-107 to read as follows: "2. Design—Standard and temporary standard designs and tread and flange contours for wrought steel wheels shall be as shown in Section G—Wheels in the A.A.R. Manual to Standard and Recommended Practice. Application for approval of designs not shown in Section G shall be addressed to the Secretary of the A.A.R., Mechanical Division for submittal to the Joint Subcommittee on Wrought Steel Wheel Design."

Suggestions were contained in the 1950 report for modification and additions in Sections 1 (b), 7, and 10 (c4). These suggestions were referred to the Committee on Specifications for Materials, which agreed to make the necessary changes with one exception and offered a further recommendation to modify Section 10 (c1) of Specifications M-107, as follows: *Proposed Form*—(c) Number of Tests.—(1) *Where continuous heat treating furnaces are used,* Brinell hardness measurements shall be made on 10 per cent of the wheels from each heat. *Where batch type heat treating furnaces are used, Brinell hardness measurements shall be made on 10 per cent of the wheels from each heat treatment lot, provided that at least one wheel is selected for test from each heat represented in the heat treatment lot.*

The committee also recommended that Section 10 (c4) of Specifications M-107 be modified and in view of the deletion of the gages for rolled to finish multiple wear wrought steel wheels from the A.A.R. Manual due to this type wheel being no longer manufactured, the committee concurred in a recommendation to modify Section 14 (a) of Specification M-107.

Suggested Changes in Pages G-21 to G-26

The preface shown on these pages in Manual Section G is no longer correct due to revisions and changed conditions. Such corrections as are necessary will be made and included in the next set of revised Manual pages. The outstanding change being made in these pages is the deletion of the old WPB designations for the various designs.

Redesign of AX-36

It was recommended, as a letter ballot item, that Design AX-36 wrought steel wheel be changed by increasing the hub diameter dimensions from the present 9½ in. to 9¾ in.

Restoring Design DX-40

It was recommended, as a letter ballot item, that previous temporary standard design DX-40 engine truck wheel, formerly shown on Manual page 151, be re-established.

The 40-in. Diesel Wheel

A recommendation was approved that a design of 40-in. diameter diesel locomotive wrought steel wheel, similar to the A-40 design except dimension G (rim thickness) changed from 2½ in. to 1¾ in., be permitted for manufacture and use not as an alternate standard but designated EXP-40 and considered as experimental until sufficient data are obtained to justify standardization.

Questionnaire on Steel Wheel Failures

On one railroad thermal cracking was a serious problem. The use of Class A wheels exclusively in this service resulted in a reduction in removal of wheels for thermal cracking from 65 per cent to approximately two per cent of the wheels in service. The experience of this road emphasizes the importance of the scope clause in Specifications M-107, which designates the classes of wheels for various classes of service and in which it is specified that for high speed service with severe tread braking conditions and moderate wheel loads, the use of Class A wheels is very beneficial.

The answers to questionnaire on thermal cracking on diesel and passenger wheels should be available by the fall of 1951.

Marking Diesel Wheels

Due to the desire of some roads to eliminate markings entirely from rims of diesel wheels, it was necessary to prepare an alternate method for marking on face of the hub of these wheels. This was shown as Fig. 2, in Appendix A and it was recommended, as a letter ballot item, that this alternate method be adopted and included in Specifications M-107.

Marking Requirements

The committee considered the possibility of simplifying marking of wrought steel wheels other than the six diesel designs. In the interest of standardization and facilitating production, a suggestion was made that the same size of dies for hot stamping char-

acters as are mandatory for the six locomotive designs be used. In accordance with this suggestion it was decided to correct Specifications M-103 and M-107.

Axle Capacity Ratings

It is recommended, as a letter ballot item, that the 1928 standard freight car axle (Fig. 8, Wheel and Axle Manual) when used in BX service, be rated in accordance with the following table and, if adopted, included in the next Supplement to the Wheel and Axle Manual.

CAPACITY OF AXLES UNDER CARS IN BX SERVICE

		Capacity in Lb. for Axles for Normal Operating Speed Ranges (Based on 72-in. Center of Gravity and 33-in. Wheels)			
		Up to 85 m.p.h.		86 to 100 m.p.h.	
A.A.R. axle designation	Size of journal in.	Std. pass. A.A.R. 1940 axle	A.A.R. 1928* std. frt. axle	Std. pass. A.A.R. 1940 axle	A.A.R. 1928* std. frt. axle
C	5 x 9	32,000	19,500	30,500	18,500
D	5½ x 10	40,000	23,500	38,000	22,500
E	6 x 11	50,000	30,000	47,500	28,500

Ultrasonic Inspection of Axles

An ultrasonic reflectoscope has been used on driving axles, crank pins and billets to check for defects which could not ordinarily be found by magnetic particle testing or common visual inspection. Five railroads are investigating this type of inspection and it is felt that under the present state of development the instrument cannot be considered as a general shop inspection tool due to the special skill which is required for interpreting results. The committee does not consider this method of inspection as an alternate to magnetic particle testing of axles but in the future it may be used for inspection of diesel axles at points where magnetic particle testing cannot be used.

Special Cars for Transporting Wheels

In the 1950 report attention was directed to the necessity for providing a sufficient number of special cars for the transportation of mounted wheels in an effort to reduce the number of damaged wheels and axles, particularly nicked axles occurring in transit.

Under existing high cost of labor and material in mounted wheel assemblies and in some cases included mounted roller bearings, it is of considerable importance that the safe transportation of this equipment to destination be secure. Nicking of axles means a complete loss of the accumulated labor cost, in addition to transportation costs, and frequently the axle is a total loss, which is considerably higher on normalized and tempered axles employed on roller bearing assemblies. It was urged that all roads give serious attention to special cars and that all roads provide a sufficient number of such special wheel cars to obviate the use of revenue flat and gondola cars.

The wheel committee reviewed, approved and referred to the Arbitration Committee certain changes in Rule 98 (i) pertaining to charges and credits for one-wear wrought steel wheels reclaimed by turning. Also, changes were proposed for revision of condemning limits, affecting Rules 71 to 82 inclusive and Rule 86 which will be further investigated and recommendations made.

Wheel Gages

Recommendation included in the 1950 report to revise the limits for condemning cast iron wheels of 80,000 lb. capacity and over, was approved by letter ballot. This action involved modifications of gages shown in the Wheel and Axle Manual, Interchange Rules and Section B of the Manual of Standard and Recommended Practice. Necessary changes have been made on Manual pages B-45, B-83, B-108, B-47, B-98, B-109 and included in the latest Manual revision.

Recommendation also was made in the 1950 report that gages for roll finished wrought steel wheels and tires, shown on Manual pages B-42I, B-42J, B-96, B-97 and B-113, be eliminated, this type of wheel being no longer furnished by the manufacturers. This recommendation was approved by letter ballot and the pages involved eliminated from the latest issue of the Manual of Standard and Recommended Practice.

A recommendation was included in the 1950 report to provide separate gages for new one wear wrought steel wheels. The recommendation was approved by letter ballot and designs for these gages to include manufacturing tolerances, were prepared for inclusion in the Manual of Standard and Recommended Practice together with new master gage and wear limit condemning gage designs. These designs are shown on Manual pages B-42I, B-42J, B-96, B-96A, B-96B, B-97, B-112B and B-113. This action also necessitated the deletion of reference "one wear wrought" from Manual pages B-41, B-42A, B-99, B-100, B-101, B-102 and B-114.

It has been found that the standard steel wheel gage, Fig. 122 of the Wheel and Axle Manual, does not condemn high flanges at 1½ inch, due to the fact that the movable finger when set for high flange, Fig. 128, condemns flange at $1\frac{35}{64}$ in. high. This will require a modification in design which is being progressed.

A simplified design of gage has been developed by some roads for gaging steel wheels to determine whether they are condemnable for high flange or thin rim. This gage can be used in place of the regular steel wheel gage, Fig. 122 of the Wheel and Axle Manual, for this purpose, the latter gage being more complicated and more expensive to furnish.

In the interest of economy and simplification, the committee recommended the use of a simplified gage of this type for roads desiring to use it. Drawings illustrating designs of this gage were shown in the report. This simplified gage is not intended to replace the standard steel wheel gage, which is necessary for use by forces whose duties require the measurements of service metal in terms of sixteenths of an inch on wrought steel wheels.

Wheel and Axle Manual Changes

Recommendation is made, as a letter ballot item, that the following changes in Section XX of the Wheel and Axle Manual be adopted and, if approved, included in the next Supplement:

1. Revise third paragraph of Rule 354 (i), as follows: *Proposed Form—When secondhand wheels removed from service are to be remounted they shall be rebored in accordance with the requirements of this rule. Dismounted misfits having bores meeting the requirements of this rule in every respect may be remounted without reboring.*

2. Revise Rule 355 (n), as follows: *Proposed Form*—Wheel seats of secondhand axles must be re-turned prior to remounting. *Dismounted misfits having wheel seats meeting the requirements of this rule in every respect may be remounted without subsequent re-turning.*

3. Change Rule 356 (b), as follows: *Proposed Form*—Wheel mounting presses must be *equipped* with a dial pressure gage and a pressure recording gage. These gages must be in *reasonable agreement within the working range* and the dial gage must be checked at least *once* every six months *of service* by means of dead weight *testing for* accurate master gage *comparison. The test record shall be marked directly on the gage, showing date and where tested.*

4. Change Second Paragraph of Rule 355 (o) as follows: *Proposed Form*—The finished journal surfaces on all axles of plain bearing type in mounted wheels *being given any machining attention* must also be magnetic particle tested before being returned to service. (Also see Paragraph 221-A for axle defects, and Interchange Rules 84, 85 and 86.)

Wheel Balance—Passenger Cars

The summary of first progress report of effect of wheel unbalance, eccentricity, tread contour and track gage on riding quality of railroad passenger cars was studied with view of determining advisability of including in Standard Wheel Specification M-107 a clause requiring the manufacturers to limit dynamic unbalance to 2.0 lb. at face of tread for wheels used on high speed or streamliner service. The following are the conclusions:

1. It is not advisable to introduce any clause in the specification concerning limitations of unbalance. This requirement can be and has been currently fulfilled by semi-finish machining of wheels where it has been ordered. The semi-finish machining here covers the machining of rim and hub fillets in addition to other machining standard to the product. This machining operation virtually assures all wheels coming within this 2-lb. unbalance limit.

2. The report of the Central Research Laboratory is a com-

prehensive and thorough analysis of the subject, and warrants careful consideration by all railroads in evaluating the needs or benefits of balancing of wheels. To this end, it is suggested that the committee give consideration to recommending that the general summary of this report be covered in a circular letter to the railroads and included in the annual report.

3. It should be noted that at least a part of the cost of balancing wheels should be offset by the lower maintenance costs of truck equipment resulting from the reduction of wear in truck parts.

4. While the wheel tread eccentricity up to 0.035 in. produced no important effect on the riding of the test car, the existing tolerances on eccentricity should be observed since this contributes to lower cost in truck maintenance. In other words, the practice of providing concentric wheels is to be encouraged. It is particularly noted that 0.035 in. tread eccentricity was comparable in the effect on riding quality to one found total unbalance per wheel.

5. With reference to tread contour, there appears to be slight difference between the two standard patterns now employed as optional standards.

The members of the wheel committee are E. E. Chapman (chairman), mechanical assistant, Santa Fe; H. H. Haupt (vice-chairman), general superintendent motive power, Pennsylvania; I. N. Moseley, research and test engineer, Norfolk & Western; A. M. Johnsen, engineer of tests, Pullman Company; M. S. Riegel, assistant engineer of tests, New York Central; R. W. Seniff, engineer of tests, Baltimore & Ohio; P. V. Garin, engineer of tests, Southern Pacific; B. C. Gunnell, chief mechanical engineer, Southern; H. E. Wagner, superintendent car department, Alton & Southern; and A. M. Guschl, general foreman wheel shop, Milwaukee.

Discussion

Clifford Stoner, Association of Manufacturers of Chilled Car Wheels, referred to the proposed reduction of 15 lb. in weight of the single-plate bracketed cast-iron wheel and said that foundry experience shows the practicability of successfully manufacturing this type of wheel without change in dimensions and with a reduction of wheel weight from 850 to 835 lb. In connection with chilled-wheel failures, Mr. Stoner said that the indicated small increase in 1950 over 1949 was partly balanced by the increase in traffic and that the real safety record of this type of wheel continues to improve from year to year. He stated that wheel defects within present wear limits may be a contributing cause of hot boxes and that more facts rather than opinions are needed regarding wheel conditions. Mr. Stoner concluded his remarks with an appeal for railroads to return all scrap chilled wheels to the foundries where this material is urgently needed to keep up the output of new wheels.

P. V. Garin, (Southern Pacific) described progress in modernizing wheel shop on this road and outlined what can be accomplished with carbide-tip tools which increase production, cut through hard spots and may be designed to give smoother finish.

C. B. Bryant, Technical Board Wrought Steel Wheel Industry, emphasized the notable performance of one road mentioned in the committee report in reducing the number of Class A wheels removed for thermal cracking from 65 per cent to 2 per cent of the steel wheels in passenger-train service. To illustrate the increased severity of wheel service due to higher train speeds, Mr. Bryant said that a comparative study showed 48,000 passenger-train miles over 60 m.p.h. at the beginning of a 10-year period had jumped to 129,000 at the end of the period. Similarly, a study of time-table speeds showed that to maintain an average of 57 m.p.h., 22 per cent of the mileage is made between 80 and 90 m.p.h. and 15 per cent over 90 m.p.h. In other words, 37 per cent of the mileage is made at speeds over 57 m.p.h.

Mr. Bryant also commented on the increased loads on passenger-car and diesel-locomotive wheels and the variation in braking load which may be 250 per cent on one car and 150 per cent on an adjoining car on the same train. He said that manufacturers are doing everything they can to produce steel wheels which will meet increasingly severe service conditions due to higher speeds, heavier loads and greater braking effort, but they are approaching physical limits of the metal itself.

Mr. Bryant closed his remarks by citing the case of a steel wheel failure investigation which showed that a wheel hub, undercut by accident in machining, was built up by welding, remachined and failed in service. He urged a wider distribution and use of the Wheel and Axle Manual as a means of education to prevent such misguided zeal in saving company material.

A. G. Hoppe (Milwaukee) referred to the marking of diesel wheels and said this is essential so as not to lose the identity of wheels which must be investigated in cases of service failure. He said that ultrasonic inspection is intriguing, needs skillful interpretation and its use should be encouraged. Mr. Hoppe referred to the failure of roller-bearing axles and said these axles must be thoroughly inspected as well as plain-bearing axles. He said that some roads are nearly out of wheels for passenger service and cars will soon have to be set aside unless more steel is made available for multiple-wear wheels for passenger service as well as one-wear wheels for freight service.

(*The report was accepted and referred to letter ballot.*)

Tank Cars

During the past year, the Committee on Tank cars gave consideration to a total of 480 dockets and applications for approval of designs. Of these, 243 covered 6,941 new shipping containers for mounting on new cars or for replacement on existing cars.

Two applications covered the construction of 17 multiple unit cars to be used for the transportation of 15 Class ICC-106A500 or ICC-106A500-X type one-ton containers each. One application covered the construction of three new underframes for the application of existing trucks and the mounting of existing Class ARA-V tanks.

Applications covering alterations in, additions to, or conversions and reconditioning of 2,626 existing tank cars or shipping containers totaled 208. Eighteen applications requested approval of tank car appurtenance designs or materials without reference to specific cars.

Upon recommendation of the committee, concurred in by the I.C.C. Bureau of Explosives on September 12, 1949 Special Permit No. 504 was issued authorizing the equipping of two Class ICC 103-B tank cars tanks and their appurtenances with Q-187 Saran rubber lining for service trials in the transportation of hydrochloric acid. Upon further recommendation of the committee, concurred in by the Bureau of Explosives and following the satisfactory completion of 18 trips by the two tank cars so equipped, the commission, by issuance of revised special permit No. 504 dated June 27, 1950, extended the authorization to 25 additional Class ICC 103-B or 1CC-103B-W tank cars.

Upon recommendation of the committee, concurred in by the Bureau of Explosives, the Commission, by suitable orders dated August 29 and November 13, 1950, amended its tank car tank specifications, as follows:

Class 103-C, Par. 6(a)—For computing rivet areas the effective diameter of its reamed hole, which hole must in no case exceed nominal diameter of rivet by more than 1/16 in. All rivets must be driven hot.

Class 106A800, Par. 14(b)—When longitudinal seam is water gas lap-welded, the mark must be ICC-106A800. When longitudinal seam is fusion-welded, the mark must be ICC-106A800X.

Class 103A-W, Par. 14(a)—Safety valves prohibited but a safety vent must be applied. Sulfuric acid, except oleum, mixed acid (nitric and sulfuric acid) (nitrating acid), and other fuming acids, may be transported in Spec. 103A-W tank cars having safety vents equipped with lead discs having 1/8 in. breather holes in the center thereof.

Upon recommendation of the Committee on Tank Cars, the General Committee approved revision of the A.A.R. Specifications for Tank Cars, to read as follows: Spec. Class ICC-103-W, 103A-W, 103B-W, 104-W, 104A-W, 105A300-W, 105A400-W, 105A500-W and 105A600-W, Par. AAR-3(a):

AAR-3(a)—All plates used for tank and expansion dome, where expansion dome is required, must be of open hearth boiler plate steel of flange quality complying with requirements of current A.A.R. Spec. M-115, or A.S.T.M. Spec. A-201, A-212, A-285 with the carbon content of the plates used not to exceed 0.30 per cent. These plates may also be clad with other metals, such as nickel, etc.

AAR-13(c)—For outlet nozzles that project 6 in. or more from shell of tank a V-groove must be cut (not cast) in the upper part

of the outlet valve nozzle at a point immediately below the lowest part of the valve to a depth that will leave the thickness of the nozzle wall at the root of the vee not over ⅜ in. In the case of steam jacketed outlet nozzles this groove must be below the steam chamber but above the bottom of the center sill construction. Where the nozzle is not a single piece, arrangement must be made to provide the equivalent of the breakage groove.

AAR-9(b)—The manhole in the dome head must be of sufficient diameter to permit access to the interior of the tank. The opening in the tank shell must must be at least 29 in. in diameter and when the opening in the tank shell exceeds 30 in. in diameter the opening must be reinforced in an approved manner.

The report was signed by Chairman J. E. Keegan, chief car inspector, Pennsylvania; F. J. Harris, mechanical engineer (car) Canadian National; J. R. Hayden, superintendent car department, Missouri-Kansas-Texas; H. S. Marsh, superintendent car department, Missouri Pacific; N. A. Passur, engineer car construction, Southern Pacific; R. S. Venning, special engineer, Chesapeake & Ohio; R. M. Smith, vice-president, Union Tank Car Company; R. T. Baldwin, secretary, The Chlorine Institute, Inc.; J. M. Dahlem, master car builder, Mid-Continent Petroleum Corporation; R. W. Thomas, manager, research and development, Phillips Petroleum Company; T. H. Caldwell, maintenance superintendent, The Dow Chemical Company.

Discussion

R. H. Smith, vice-president, Union Tank Car Company, called attention to the fact that all but 38 of the 6,941 new shipping containers were of fusion-welded construction and complimented the committee on developing designs and specifications which assure the success of this radically new method of fabrication. He said that the first welded tank-car tank was built in 1932 and this type of construction was approved by the I.C.C. in 1941.

(The report was accepted.)

Axle and Crank Pin Research

This report is the first made by the committee since it was formed in 1949 by consolidation of the former Committee on Axle Research and the Committee on Crank Pin Research.

Passenger Car Axle Tests

The eighth progress report covering fatigue testing of quenched and tempered 5½-in. by 10-in. carbon steel axles at the Timken Roller Bearing Company's laboratory was approved by the committee and issued by the Mechanical Research office in February 1950.

Locomotive Crank Pin Tests

The 4th progress report covering tests of normalized and tempered and quenched and tempered crank pins at the Timken laboratory has been approved by the General Committee and distributed to the membership.

Current Committee Assignments

In addition to the following list of assignments the committee has reviewed drafts of the preliminary ninth progress report on passenger-car axle tests and a supplement to the fourth progress report on crank-pin fatigue tests. The status of the committee assignments is:

1. The development of a new design of freight-car axle, following the general dimensions of the raised-wheel-seat standard axle for passenger cars, with an "as forged" surface between the wheel seats instead of a machined surface. In collaboration with the American Iron & Steel Institute's Committee on Axles and Locomotive Forgings two lots of 5½-in. by 10-in. axle forgings have been produced. These experimental forgings are at the Timken laboratory for comparative tests with Design No. 1 (A.A.R. 1928 standard freight car axle) and Design No. 6 (A.A.R. standard passenger car axle.)

2. Laboratory investigations of overheated journals did not support the claim that axle failures classified as burned-off journals were due to the progression of cracks resulting from service stresses. Because of the importance of the subject the committee decided to initiate a test program to investigate service stresses in the journal area.

3. A table showing the capacity in pounds of axles under cars in BX (box express) service, based on a 72-in. center of gravity and 33-in. wheels, has been approved and submitted to the Committee on Car Construction. If concurred in, the table will be submitted as a letter ballot item for inclusion in the next Wheel and Axle Manual supplement.

4. Studies of "as forged" axles are being made in collaboration with the A.I.S.I. committee. It is proposed to use a dynamic balancing machine to measure the unbalance of axles having variations in "run out" at the center of the axles.

5. Tests are in process of M-101 axles as forged, and stress relieved.

6. On the basis of questionnaire returns the committee decided that additional tests of axles with generator pulleys are not desirable or necessary.

7. Tubular axle designs with increased wheel-seat diameter submitted by the manufacturer are being studied.

8. Committee recommendation on axle capacity ratings when used in tender service was concurred in by the Locomotive Construction Committee and approved by the General Committee for publication as recommended practice.

9. The committee recommendation on design, finishing instructions and application procedure for locomotive crank pins and wheel centers, with the report covering recommended practice to be followed in making fits with pre-stressed bores and rolled wheel fits, was concurred in by the Locomotive Construction Committee for adoption as recommended practice.

10. The axle journal (two-step diameter) for roller bearing application to freight car truck side frames of integral box type was approved by the committee for engineering design.

11. A program of laboratory tests on the development of fatigue cracks between wheel seats and covering a dynamic investigation of roller bearing passenger axles at high speeds is being studied.

12. Protective surface coating for the body portion of axles, proposed by a committee member, is being studied.

13. An investigation is being made of reports of tubular axle failures received from member roads.

The members of the committee are J. R. Jackson (chairman), mechanical engineer, Mechanical Division, A.A.R.; K. Cartwright, chief mechanical officer, New Haven; W. F. Collins, engineer of tests, New York Central; H. L. Decker, assistant mechanical engineer, Pennsylvania; H. H. Haupt, general superintendent motive power, Pennsylvania; F. J. Herter, engineer car construction, Chesapeake & Ohio; A. M. Johnson, assistant chief engineer equipment, New York Central system, and E. H. Weston, mechanical engineer, Chicago & North Western.

Discussion

The discussion centered chiefly on broken journals and the causes. The committee stated that their study concerned service stresses in the journal area, and they did not consider failures due to copper infiltration. It was hoped that the study can be continued with the hot-box alarm machine at Altoona as it can be used without modification. The committee hoped to test full, 1¼ and 1½ loads at 50, 75 and 100 m.p.h., using 5½-in. by 10-in. journals on 33-in. wheels. One 5-in. by 9-in. journal will also be tested, and the lubrication will be reduced at full load and 75 m.p.h. to investigate the heating and stresses.

Several roads reported experiences with journal failures. One found that about half showed no evidence of being caused by overheating. What heating was found was thought to have been caused by flexure after a fatigue crack had weakened the section. Another road found that 22 burned-off journals showed evidence of overheating in all cases, and there was copper penetration. A third road subscribed to the theory of copper penetration as being one of the main causes of burned-off journals; only one per cent breaking with no signs of heating.

The D. L. & W. ran a test on a loaded 70-ton hopper car to verify laboratory work on copper infiltration. A copper-free bearing ran red hot for 67 miles and was still intact. Lubrication was then removed from under a bronze bearing, and it burned off in 34 miles. The conclusion was that failure occurs two-thirds of the way from the axle collar where maximum heating occurs. There-

fore stresses are not considered. The journal breaks where it is in contact with copper.

(*The report was accepted.*)

Brakes and Brake Equipment

Charging Long Freight Trains

At the request of the committee the air-brake manufacturers have conducted extensive tests to determine how increasing the diameter of the opening through the hose coupling gasket would affect reducing freight-train charging time. These tests showed that a 1¼-in. opening would be the largest practicable opening in a gasket for fitting the recess of the standard hose coupling.

It was concluded from test results that little, if any, improvement in the charging time would be obtained by increasing the gasket opening from 1-3/16 in. to 1¼ in. Additional tests were then made to determine the maximum possible decrease in charging time resulting from the complete elimination of all coupling restrictions such as might be produced by a new coupling of a completely different size and a much larger gasket. Depending on the leakage and main reservoir pressure conditions, the deductions in charging time for train lengths of 50 to 150 cars varied from 5.5 to 17.7 per cent as compared with tests run with standard hoses and hose couplings. The air-brake manufacturers emphasized that to obtain even a part of this reduction in charging time would require an entirely new coupling and gasket with its attendant serious interchange problem. These tests also emphasized that the effect of opening the present hose-coupling gaskets to 1¼-in. diameter would be insignificant.

Tests run on a 150-car train equipped with hose-and-nipple combination (no coupling restriction) to determine the effect on service and emergency transmission showed that the performance of the AB brake would not be adversely affected.

AB Load Compensating Brake

The 25 Illinois Central 50-ton hopper cars equipped with the ABLC brake were inspected and given the single-car test after an average of 16 months of service. Following the test the operating portions were removed for rack test and examination with the following results:

Except for seven cases of inoperative slack adjusters due to burning of either the adjuster or the hose all brakes passed the single-car test. The railroad is planning to locate the adjuster at a less vulnerable point on 100 cars for trial.

Except for three cases where minors defects were found, all compensating valves passed all tests in the rack code for cleaned and repaired valves.

The brake cylinders were in good condition and well lubricated.

Two slack adjusters were replaced, one because of damaged teeth due to improper assembly and the second because of burning and rewelding of the body. Most slack adjuster hoses were replaced.

A complete report of the inspection and tests will be compiled as soon as possible.

Freight-Car Slack Adjusters

As of March 26, 1951, the following number of automatic freight-car slack adjusters were either in service or so contemplated by the end of next year on the railroads represented by members of the committee:

Mechanical adjusters: Universal, 135; King, 1,127; Ajax, 1,052; Gustin-Bacon, 102 and Locomotive Finishing Company, 50. Pneumatic adjusters: Westinghouse Air Brake Company, 565 (including 398 in service on the Illinois Central's ABLC equipment), and Ajax, 6.

The committee suggests that all roads make as many trial applications as possible so that service performance may be determined. The committee believes that the time is fast approaching when some form of slack adjuster should be recommended for application on all freight cars.

Revisions to Rules and Specifications

The committee has requested the Arbitration Committee to consider amplifying the stencil notes on the sketch, Page 135, Rule 60, in the Code of Rules from "Stencil here in location which presents clearest view from side of car" to read "Stencil on either side or either end of reservoir presenting clearest view from outside of car."

The revision of rules governing the maintenance of brake and train air signal equipment have been completed and forwarded by the General Committee to the I.C.C. Bureau of Safety for final approval.

The revision of A.A.R. Specifications No. 2518—Installation of AB Freight Brake Equipment has been completed and the air-brake manufacturers will be in a position to furnish them.

Charging Two Cars at One Time

To conserve time in charging air brakes prior to making single-car tests, two different devices have been designed for charging air brakes on two cars at the same time. A circular letter, dated

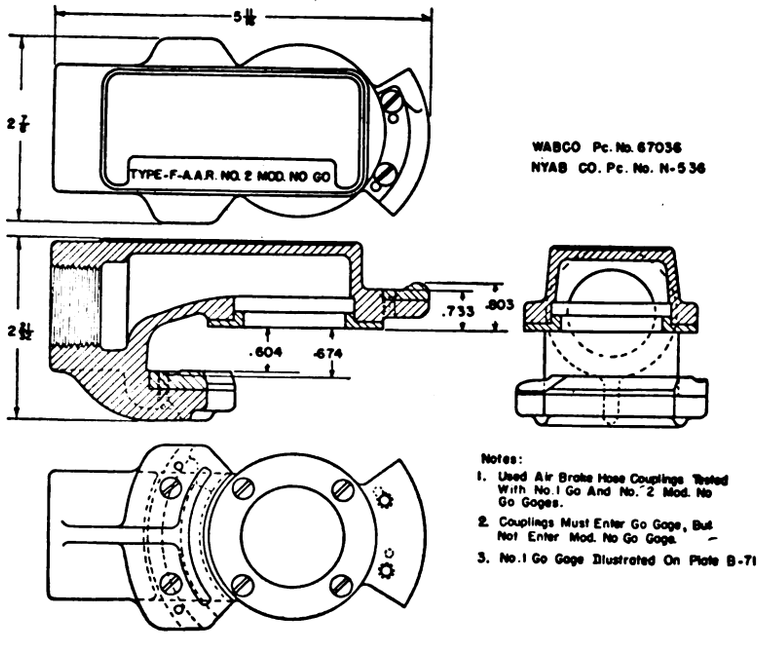


Fig. 1—Modified no-go hose coupling gage that condemns 15 to 25 per cent of worn couplings now passed by the present gage

February 5, 1951, explaining these devices was issued by the secretary. The use of these devices is permissible providing all details are strictly followed. Much time can be saved thereby. The intention is to incorporate these devices in the next revision of Air Brake Instruction Pamphlet No. 5039-4 Sup. 1.

Letter Ballot Items

The committee recommends the following as letter ballot items:

That Manual Page E-14 be revised by adding a new paragraph to provide instructions for applying the alternate standard type of hose nipple, and that Page E-17 be revised to coincide with the change in the instructions.

That a new Page E-78-A be added to include the 2½-in. steam-heat coupler head. Also, that Page E-78-1947 be revised to change the incorrect 1-7/16-in. radius at the latch portion to the correct dimension of 2-7/16-in.

The Manual Page B-72 be revised to include a gage, modified by the manufacturers by request, that will condemn 15 to 25 per cent of the badly worn brake lips and grooves of the brake-pipe hose coupling that are passed by the present gage. Its adoption will reduce the number of worn couplings now being reused which may be responsible for excessive brake-pipe leakage in freight trains.

That Manual Page E-14 be modified so that water may be used as a bonding agent when mounting rubber air-brake hose. Tests conducted by several members of the committee indicated that water is satisfactory for this purpose.

That the double-lip "Canadian" type of air-hose gasket be adopted as an A.A.R. alternate standard gasket and included in Specification M-602, Section A of the Manual. This gasket has been in service on some of the roads represented by the committee members and a marked improvement was made in reducing brake-pipe leakage, especially when used in worn hose couplings.

Subjects Under Consideration

The committee is considering or investigating the following items:

Brake system leakage on freight-train cars is being actively investigated to determine what further action could be taken to reduce leakage.

Standardization of air brake equipment on diesel locomotives.

Elimination of oil and moisture from air lines, particularly on diesel locomotives.

Location of AB valves on standard hopper cars.

Investigation of electro-pneumatic brake-circuit checking devices for diesel locomotives.

Investigation of terminal charging facilities for freight trains to reduce the moisture in yard air lines.

Condemning gage for use on AB valve gaskets.

The members of the committee ar J. P. Lantelme (chairman), assistant engineer, Pennsylvania; H. I. Tramblie, (vice-chairman), air brake engineer, Burlington; R. J. Dewsbury, general air brake inspector, Chesapeake & Ohio; R. N. Booker, general air-brake inspector, Southern Pacific; W. D. Bowser, engineer air brakes and train-control design, Union Pacific; D. R. Collins, superintendent air brakes, Denver & Rio Grande Western; F. T. McClure, supervisor air brakes, Santa Fe; A. J. Pichetto, general air brake engineer, Illinois Central; L. D. Hays, engineer brake equipment, New York Central; L. A. Stanton, general air brake instructor, Great Northern; and C. C. Maynard, chief inspector air brakes, Canadian National.

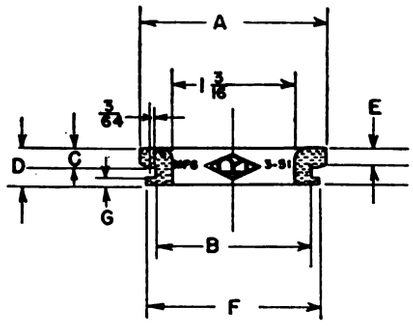
Discussion

R. E. Baker (Boston & Maine) said that excessive brake-pipe leakage still causes trouble in train operation, particularly in sub-zero temperatures, and this leakage occurs not only at AB valve back covers, but on angle cocks, old hose couplers and in the brake-piping system. He questioned the desirability of reducing tolerances in the no-go hose coupling gauge, as suggested in the report, and also the economics of requiring the application of slack adjusters to all freight cars which are on repair track periodically for other work.

F. G. Moody, (Northern Pacific), also advised going slowly before making slack adjusters mandatory on all freight cars owing to maintenance difficulties. He said that railroads in the Northwest had hoped for more definite recommendations for reducing brake-pipe leakage in the committee report, the magnitude of this difficulty being indicated by the fact that last winter the Northern Pacific had to reduce the length of 105 trains an average of 11.7 cars per train to keep rear-end brake-pipe pressures within desired limits. Mr. Moody indicated that little real progress has been made in reducing leaks at AB valve back covers, ball-check covers and gaskets.

At the request of Chairman Lantelme, H. I. Tramblie, (C. B. & Q.), explained that the committee did not enlarge on the subject of brake-pipe leakage which was thoroughly covered in previous reports. He said that leaks other than those at AB valves need more attention and that freight cars are not now getting in-date air-brake tests while on repair tracks as generally as desirable. He urged chief mechanical officers to explain what steps are being taken to get this important work done.

(*The report was accepted and referred to letter ballot.*)



	A	B	C	D	E	F	G
Min.	1.796	1.484	.166	.341	.135	1.6719	.074
Nom.	1.812	1.500	.171	.343	.140	1.687	.078
Max.	1.828	1.515	.176	.354	.145	1.7031	.0831

Fig. 2—Double-lip "Canadian" type air hose coupling gasket

Safety Appliances

During the preceding year the committee considered a total of 101 applications for approval of designs of safety appliance details for use in construction, alterations or conversions of tank cars, as follows:

Item	No. of Designs
Dome platform arrangements	53
Dome step arrangements	19
Dome step and platform grating arrangements	24
General arrangements	3
Runway arrangements	1
Safety railing arrangements	2
Side ladder arrangements	43
Total	145

Since the last report, one new design of metal running board has been investigated, tested and approved. This design has been listed in the Interchange Rules under "Steel Running Boards" in Groups 1, 2 and 3 as "William F. Klemp Company's Welded Grating."

Application for approval of another new design of metal running board from another company is now under consideration. Application for change in securement details of another metal running board already included in the approved list is also being considered.

Progress was reported on revising the publication entitled "Maintenance of Air Brake and Air Signal Equipment on Locomotives and Cars."

The interested committees are following the service performance of the Illinois Central's 398 lightweight hopper cars equipped with "ABLC" brake equipment. The brake equipment on 25 of these cars, which have been in service an average of 16 months was inspected by the Committee on Brakes and Brake Equipment, and a summary included in that committee's report.

Members of the committee are R. G. Henley (chairman), general superintendent motive power, Norfolk & Western; H. T. Cover, assistant vice president and chief of motive power, Pennsylvania; G. W. Bohannon, chief mechanical officer, Chicago & North Western; F. K. Mitchell, manager of equipment, New York Central; J. M. Nicholson, mechanical and research engineer, Santa Fe; A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio.

(*The report was accepted.*)

Labor and Material Prices

Labor rates

Immediately upon receipt of announcement of the 12½ cents increase in hourly wage rates paid to employees engaged in car repairs, all combination labor and material allowances in Rules 101, 107, 111 and Passenger Car Rules 21 and 22 were reviewed and the labor portion modified in Supplement No. 1 to the 1951 Code, effective April 1, 1951.

Item 92 in Rule 107, and items 19, 19-A and 20 in Passenger-Car Rule 21 covering labor rates were increased and these changes were announced in circular letter issued by the secretary on March 3, 1951, effective as of March 1.

Upon receipt of announcement of a further increase of six cents in hourly wages paid to employees engaged in car repairs, all combination labor and material allowances in Rule 101 were reviewed. However, it was found that applying the six-cent increase resulted in only a small increase in the large majority of the items. No further modifications in this rule were recommended prior to the usual August 1 Supplement.

Following the wage increase, Item 92, Rule 107, covering freight-car labor, was increased to $3.10 per hour and key items in this rule modified accordingly. Items 19, 19A and 20 of Passenger Car Rule 21 were similarly modified. These changes were announced in a circular letter issued by the Secretary on April 27, 1951, effective as of May 1, 1951.

Rule 101—All miscellaneous material prices in Rule 101 were rechecked as of March 1, 1951, quotations submitted by the purchasing agents of the ten selected railroads, representing 39 per cent of total freight-car ownership in the United States and Canada, showing an upward trend in material markets as indicated by detail recommendations for revisions shown under this rule.

A new note is added following Item 1 to provide the basis for charges and credits for all sizes and designs of armored-type air hose. Item 115-A covering brake-beam safety chain is obsolete and is eliminated. A new note is added following Item 169-I to provide charge for R. & R. of packing retainer devices on cars so stenciled, when in connection with periodic repacking of journal boxes.

Rule 107—A new Item 100-A is added to provide labor charge for packing retainer devices applied separately.

Rule 111—Paragraph 1 is modified to indicate that release valves mentioned therein do not include AB Duplex reservoir release valve.

Rule 112—Recommendations are made in this rule respecting reproduction pound prices of new freight cars of all classes, in order that Supplement of August 1, 1951, may reflect 1950 costs in lieu of figures shown in the present Code. New prices recommended are based on the cost of 23,500 freight cars constructed during the year 1950. The last sentence of Par. 4 Sec. B is modified to indicate that Class XIH cars shall be settled for on reproduction cost basis.

Passenger Car Rule 22—Item 14-A is modified to clarify the intent that same applies to current from a d.c. line. New Item 14-B and new note following are added to provide a charge for electric current on cars equipped with a.c. conversion apparatus.

Time studies are to be made by a special subcommittee covering periodic attention to AB and AB-1-B type and D-22 type air brake equipment. When these studies are completed, and if results justify modification of existing allowances or the addition of new items, such changes or additions will be made.

Further studies are to be made covering periodic repacking of journal boxes, on passenger as well as freight equipment. If the results of this study justify modification of existing allowances, such changes as are necessary will be made.

A joint study is being made by a special subcommittee composed of members of the Committee on Prices for Labor and Materials and the Committee on Couplers and Draft Gears, to determine whether or not the present secondhand allowances and average credits for approved and nonapproved types of friction draft gears, as specified in interchange Rule 101, are equitable. If the result of this study indicates modifications are necessary, such changes will be made.

In view of the possibility under present labor contract arrangements of there being four changes each year on account of fluctuation in cost of living allowances, plus the regular scheduled issuance of supplements, it is felt that the Arbitration Committee should review this situation from a policy viewpoint and determine what should be done to cope with it with the least confusion.

It is the intent of the committee to investigate labor and material costs again in October; if sufficient change develops, necessary revision will be made and inserted in the rules effective January 1, 1952.

Where price change only is involved, the wording of many of the price items contained in this report has been abbreviated, in the interest of brevity and the reduction of unnecessary material.

The report was signed by Chairman T. J. Boring, general foreman, M. C. B., Clearing House, Pennsylvania; Vice-Chairman P. F. Spangler, superintendent car department, St. Louis-San Francisco; J. D. Rezner, superintendent car department, Burlington; L. B. George, assistant chief motive power and rolling stock, Canadian Pacific; G. J. Flanagan, general car inspector, New York Central; R. M. Smith, vice-president, Union Tank Car Company; A. H. Gaebler, superintendent car department, General American Transportation Corporation; L. R. Schierbecker, assistant superintendent car department, Illinois Central.

(*The report was accepted.*)

Geared Hand Brakes

A. A. R. certificates of approval have been issued for 31 types of geared hand brakes—19 vertical-wheel, 9 horizontal-wheel and 3 lever types. The changes to be made in the listings of A. A. R. approved hand brakes as shown in Interchange Rule 101 (Code of Rules dated January 1, 1951) are:

Manufacture of The Orme Company's Champion vertical-wheel hand brake, Drawing 1124, has been discontinued.

Manufacture of Klasing vertical-wheel hand brake, Drawing D-959, has been discontinued, except for repair parts.

Klasing vertical-wheel hand brake, Drawing D-1051, is added to the list.

Superior vertical-wheel hand brake, Drawing 726, is added to the list.

Union Asbestos & Rubber Company's (Equipment Specialties Div.) vertical-wheel hand brake, Drawing 3750, is changed to Drawing 3750-A.

Superior horizontal-wheel hand brake, Drawing 565-E, is added to the list.

Superior horizontal-wheel hand brake, Drawing 603-D and 668-B, is changed to Drawing 603-E and 668-A.

Standard Bell Crank—Tests of the A.A.R. 50 bell crank (shown in Fig. 1, 1950 report) show that the variations in power, when substituted for the manufacturers' designs, are relatively slight. Therefore, retests of certified hand brakes because of this substitution are not considered necessary. The committee recommended, as a letter ballot item, that A.A.R. specifications be revised to include the requirement that the A.A.R. 50 bell crank be furnished

with all vertical-wheel and lever-type hand brakes, and that the drawing be incorporated in the manual.

Sheave Wheel—Certificates of approval for lever-type hand brakes are based on tests of these brakes in combination with bell cranks. To protect situations where it is necessary to substitute a sheave wheel for the bell crank the committee recommended, as a letter ballot item, that a paragraph be included in the A.A.R. specifications for geared hand brakes to make sheave wheels permissible providing multiple levers are used to bring the power of the piston up to the required force.

Uniform Brake Chain Length—Tentative agreement has been made of a standard length of 21-9/16-in. from the center line of the lower attachment rivet hole in the housing to center line of clevis rivet or bolt (connection to vertical pull rod). In the interests of interchangeability the brake chain (upper unit) for geared hand brakes of the vertical-wheel type should be furnished accordingly.

Non-Standard Hand Wheels—The committee is investigating the interchangeability of hand wheels desirable from a maintenance and repair point of view. Exceptions have been taken to this procedure because it makes correct identification of the various makes confusing and difficult.

Location of Brake Step—The drawings in the Supplement to the Manual have been changed to show the brake step level with the adjacent end ladder tread as recommended in the 1950 Report.

Foot-Operated Geared Brake—Tests of a full-size metal model of a foot-operated brake developed by a railroad employee showed it to be materially deficient in power, indicating the need for radical design changes. The matter is being continued for further consideration and consultation with the inventor.

The members of the committee are E. P. Moses (chairman), engineer car equipment, New York Central System; J. P. Lantelme, assistant engineer, Pennsylvania; H. L. Holland, assistant mechanical engineer, Baltimore & Ohio; W. A. Pownall, assistant to general superintendent motive power, Wabash, and J. R. Jackson, mechanical engineer, Mechanical Division, A.A.R.

(*The report was accepted and referred to letter ballot.*)

Sanitation Progress

On completion of the sanitary research project, under the supervision of the Joint Committee on Railway Sanitation and under the direction of Dr. Abel Wolman, the positions of sanitary engineer, mechanical engineer and secretary were transferred to the central research laboratory at Chicago, the group being identified as the Office of Sanitary Research.

The "Final Report of the Railroad Members of the Joint Committee on Railway Sanitation," accompanied by a summary report of the development work carried on by the research project since January 1946, was submitted to Vice-President Aydelott on February 28, 1951. Copies are being referred to the General Committees of the Operating-Transportation, Mechanical, and Engineering Divisions for comment and recommendations as to further handling.

The committee lists four additional technical reports which have been distributed to the railroads. These are: No. 5, A Study of Passenger Traffic and Its Relation to Quantities of Toilet Wastes; No. 6, Bacteriological Studies of the Effects of Human Waste from Passenger-Carrying Cars on Railroad Right-of-Way; No. 7, Retention of Sewage Wastes from Railroad Passenger Cars, and No. 8, Disposal and Treatment Processes for Sewage Wastes from Railroad Passenger Cars.

The committee has reviewed with the U. S. Public Health Service a number of proposed changes in the Interstate Quarantine Regulations, a revised edition of which will soon be available. It has also cooperated with that service in the preparation of three new handbooks on Sanitation of Railroad Servicing Areas, Sanitation of Railway Passenger Car Construction, and Sanitation of Dining Cars in Operation. These will in due course supersede the Sanitation Manual for Land and Air Conveyances Operating in Interstate Traffic and A. A. R. Circulars M&S 133 and M&S 194.

Service test of the Sphincter Retention Valve applied to some of the toilet hopper chutes of a New York Central sleeping car continues, with no difficulties of consequence reported to date.

The members of the joint committee are as follows: Mechanical Division: E. P. Moses (chairman), engineer, car equipment, New York Central system; E. E. Chapman, mechanical assistant, Santa Fe; H. M. Wood, assistant chief of motive power car, Pennsylvania. Engineering Division: R. C. Bardwell, superintendent water supply, Chesapeake & Ohio; H. W. Van Hovenberg, engineer of tests and sanitation, St. Louis Southwestern; A. B. Pierce, engineer of water supply, Southern system. Medical & Surgical Section: Dr. R. M. Graham, director, department of sanitation and surgery, Pullman Company; Dr. A. M. W. Hursh, chief medical examiner, Pennsylvania. U. S. Public Health Service: Mark D. Hollis, assistant surgeon-general, chief sanitary engineering division; E. C. Garthe, sanitary engineering division, in charge land and air carrier division; C. H. Atkins, sanitary engineer, land and air carrier section. Department of National Health and Welfare, Canada: J. R. Menzies, chief, public health engineering division D. Secretary, H. S. Dewhurst.

(*The report was accepted.*)

Car Construction

[The committee included in the report tables showing that of 93,677 new house and hopper cars ordered from May 1, 1950, to April 30, 1951, inclusive, all conformed to A.A.R. standards of design, throughout or conformed thereto essentially, except for variations in inside dimensions to meet specific conditions, including lightweight low-alloy steel cars, and cars with floating center sills (1,300 box cars). Of the 143,588 cars of the flat, gondola, hopper, refrigerator, stock and special types ordered during the same period, 136,172, or 94.8 per cent, have the standard 25¾-in. center-plate height.—EDITOR.]

News Freight-Car Designs

In accordance with Interchange Rule 3 three new freight-car designs were reviewed and approved for interchange service during the year, as follows: Car structure for mounting two-unit glasslined tanks of 7,800 gal. total capacity to be used in the transportation of chlorosulphonic acid, General American Transportation Corporation; a structure, including anchorage, to be used for transportation of 15 one-ton containers and contents, American Car & Foundry Co.; flat car, 50 tons capacity, Virginian.

Alternate Hopper-Car Bolster

An improved bolster brace at the center sill, has overcome failures of the I-beam body bolster included in the "Victory" designs of 50- and 70-ton self-clearing hopper cars. It is recommended for adoption as an alternate standard. It saves approximately 300 lb. per car and is cheaper to fabricate and apply than the built-up construction.

Refrigeration Research

Reports have been made on the work accomplished on standing and laboratory tests as well as on road tests of various aspects of refrigeration. A large part of the standing and laboratory tests have been directed to the use of salt and ice mixtures. These include tests of various percentages of salt and bunker ice, including the use of various types of mined and sea salt, some with inhibitors in the ice and salt mixtures, analysis of salt samples in use by car lines and carriers and a study of commodity temperatures using salts other than NaCl on bunker ice in shipments of frozen foods.

A report to the United Fresh Fruit & Vegetable Association Committee on Refrigerator Cars, looking toward the standardization of loading and unloading platform construction, was also mentioned. Road tests reported include a comparison of overhead bulkhead fans with floor fans in transcontinental tests, a comparison of standard refrigeration against a limited number of reicings, transcontinental tests on frozen food using various percentages and sizes of salt on bunker ice, and a test by the U. S. Department of Agriculture of the use of alcohol heaters in the transportation of bananas between New Orleans and Winnipeg, Man.

Work recommended for 1951 by the committees supervising these studies includes a series of individual car tests between

Chicago and New York to develop new rules reducing ice issues; frozen-food tests, using new equipment, for the use of legal departments before the Interstate Commerce Commission on truck hearings; ventilation tests on tomatoes in cars moving through changeable and cool weather, and on potatoes. Studies are now taking place looking toward frozen-foods tests with mechanical refrigeration and other new types of refrigerator cars.

The question of insulation studies was deferred to the next general meeting. The refrigerator car research division has been instructed to study the absorption of water vapor by insulation.

Fire-Resistant Insulation

Where heat is used in repair operations on refrigerator cars fires break out in certain insulating materials after the work has been done. The committee proposes for letter ballot determination that supplement to Manual Plate C-2, Specifications for Standard Freight Refrigerator Cars, be modified by the addition of the following to Item 9—Insulation: "Insulation used must be such that it will not support combustion, which will include enveloping materials used in connection with blanket form insulation."

Pressed Steel Plywood Box Car

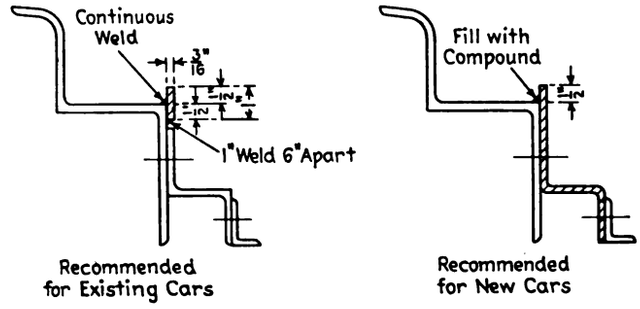
Up to the present the pressed steel box car has satisfactorily passed the compression test. It is now being tested in freight service directly behind the locomotive on the Milwaukee in freight runs between Chicago and the Pacific Northwest.

Freight Car Details

Nailable Steel channel-type flooring is strong enough to be used with one 3-in. 6.7-lb. longitudinal floor stringer on each side of the center sill, with conventional crossties and crossbearings, if the steel floor sections are welded to the stringer. This is proposed for letter ballot action.

Damage caused by water dripping from car roofs at doorways, of which shippers of flour-mill and similar products complain, can be prevented at small cost in the construction of new cars or on rebuilt cars. Drawings covering the design of a water deflector for existing cars and for new cars have been prepared for inclusion in a revision of the Supplement to the Manual.

Changes in and additions to the drawings of standard steel-



Water Deflector to extend 12 In. each Side of Door Post

Water trough over doorway for A.A.R. standard box car

PRELIMINARY SUMMARY OF 1950 COOPERATIVE FREIGHT-TRUCK AND SNUBBER RESEARCH PROGRAM

Manufacturer and design designation	Truck spring arrangement		Rail load 169,000 lb.—Speed up to 65 m.p.h.					Rail load 145,000 lb.—Speed up to 90 m.p.h.					Rail load 60,000 lb.—Speed up to 90 m.p.h.				
				Lading damage index					Lading damage index					Lading damage index			
				Vertical		Lateral			Vertical		Lateral			Vertical		Lateral	
	No. double coils per Car Set	Travel in	Avg. speed	Yardstick Car ASFX-1940	Companion Car ASFX-1941	Yardstick Car ASFX-1940	Companion Car ASFX-1941	Avg. speed	Yardstick Car ASFX-1940	Companion Car ASFX-1941	Yardstick Car ASFX-1940	Companion Car ASFX-1941	Avg. speed	Yardstick Car ASFX-1940	Companion Car ASFX-1941	Yardstick Car ASFX-1940	Companion Car ASFX-1941
ROAD TESTS OF CONVENTIONAL SPRING-PLANKLESS DOUBLE-TRUSS TRUCKS WITH A.A.R. 1948 COIL-SPRING UNIT SNUBBER COMBINATION PER MANUFACTURERS RECOMMENDATION																	
Miner C-5-L snubber[2]	16[1]	2½	44.4	9427	30375	2594	2735	....	....	....	....	....	44.8	11355	24141	3019	5446
ROAD TESTS OF CONVENTIONAL SPRING-PLANKLESS DOUBLE-TRUSS TRUCK PACKAGE GROUP SNUBBERS																	
Barber SP-21-A package	16	2½	45.6	10828	12965	3124	2151	62.0	32331	26505	5794	11220	56.9	24828	74969	5358	10315
Cardwell P-50 package[3,4]	16	3 1/16	44.8	10264	7764	2129	1428	59.4	33732	25969	5734	4200	65.4	51536	50251	13484	8064
Frost package snubber[5]	16	3 1/16	44.7	10217	5276	2091	2069	58.4	27265	17781	7000	3421	62.3	36628	64968	8236	5832
Miner P-1 package	16	2½	42.1	9544	7993	2381	3282	62.3	30000	22844	6126	10188	59.8	41021	38933	8429	7002
ROAD TESTS OF SPECIAL DESIGNS OF HIGH SPEED TRUCKS WITH LONG TRAVEL SPRINGS AND BUILT-IN SNUBBING DEVICE																	
Barber S-2-A truck	20[6]	2½	45.4	11320	7716	2461	2940	66.0	33006	26601	4922	6145	65.3	55595	57955	11879	4741
Monroe shock absorbers[8]	20[7]	2½	37.7	824	13378	401	1685	....	....	....	....	....	....	....	....	....	....
Barber S-2-B truck[13]	20[9]	3 1/16	43.6	9202	6276	2193	2267	62.8	33348	22427	6875	3411	64.3	49377	43323	9045	6292
Scullin LV-50 truck	20	3 1/16	44.9	9519	1806	2472	685	60.0	32043	7604	6375	3223	66.9	52383	42192	9771	5093
SKF roller bearings—Y 7571 Arrg. ASF A-3 truck[10]	20	3 1/16	42.9	9257	2056	2106	177	61.9	29573	12188	9637	899	61.1	47887	30360	9559	1345
SKF roller bearings—Y 7566 Arrg. ASF A-3 truck[10]	20	3 1/16	43.5	8325	1783	1938	161	56.7	29232	8384	7841	469	59.9	39735	26080	8640	314
Holland R-S-8 truck	20[11]	2½	42.8	7571	5571	1575	2879	62.7	29773	27100	6525	6496	59.6	39096	31552	8610	8390
Holland R-S-8 trucks C.E.S.D. springs	20[12]	3 1/16	42.7	8555	7357	2001	2030	60.6	25024	26308	5144	6593	61.9	40629	28452	8623	6633
Endsley tapered column truck	20	3 1/16	44.0	8862	3187	2106	955	58.0	27300	13426	6573	2687	62.6	46097	54155	10066	4901
Scullin CC truck	20	3 1/16	44.1	9242	1497	1923	841	62.9	29542	7709	7356	2131	63.4	47195	42082	8544	4780
National C-1 (lateral motion) truck	20	3 1/16	44.1	10846	3045	2162	1257	63.9	31630	19874	7694	4011	62.1	48383	37673	11602	5876

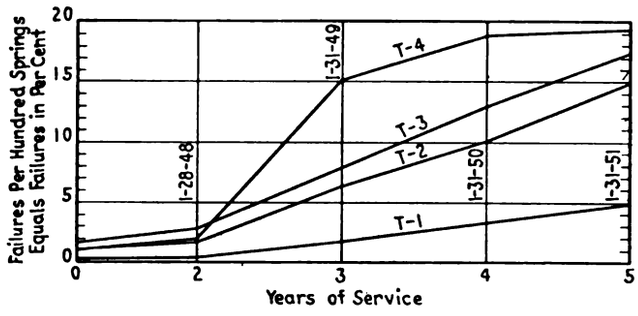
[1] 16 outer coils, 12 inner coils and 4 snubbers.
[2] Speed up to 65 m.p.h. in the 60,000-lb. run.
[3] Total trip mileage reduced from 124 to 123 miles on the 145,000-lb. run.
[4] Maximum speed limited to 79 m.p.h. by Illinois Central Operating Department on the 145,000-lb. and 60,000-lb. runs.
[5] Total trip mileage reduced from 124 to 121.7 miles account of hot journal on the 145,000-lb. run.
[6] Barber "S-2-A" Trucks equipped with 20 outer coils and 4 inner coils per car set.
[7] Monroe Trucks equipped with 20 outer coils and 8 inner coils per car set.
[8] Speed restricted to 40 m.p.h. after 26 miles of N. B. Run. Monroe Trucks withdrawn after N. B. Run at the request of the manufacturer.
[9] Barber "S-2-B" Trucks equipped with 20 outer coils and 16 inner coils per car set.
[10] American Steel Foundries "A-3" truck—Pedestal type with SKF Roller Bearings.
[11] Holland "R-S-8" Trucks equipped with 20 outer and 8 inner coils per set.
[12] Holland "R-S-8" (C.E.S.D.) Trucks equipped with Holland Constant Effective Static Deflection Springs, 20 outer coils and 16 inner coils per car set.
[13] Maximum speed limited to 79 m.p.h. by Illinois Central Operating Department on the 145,000-lb. run.

NOTES:

American Steel Foundries 5-car service laboratory operated as special train over Illinois Central Rails—Clinton to Gilman, Ill. Road tests as run between April 19 to July 18, 1950.

All devices were tested in new or broken-in condition.

The trucks under the "Yardstick Car" (ASFX—1940) were equipped with ASF "A-3" Ride-Control Trucks with 2½-in. travel spirngs. These trucks remained under the "Yardstick Car" during the entire 1948, 1949 and 1950 road test programs.



A.A.R. service-life test of helical springs in fright cars. Outer-coil failures as reported for 2, 3, 4 and 5 years of service

sheathed box cars in the Supplement to the Manual recommended by the committee last year because of changes in methods of loading and improvements in shop practices have been made. The major changes thus effected are: strengthened body bolsters (1/16 in. thicker webs and 3 in. wider top cover plate); floor stringers continuous in one piece between bolsters; crosstie added at the center of the car on both 40- and 50-ton steel-sheathed box and auto-box cars; an alternate of six floor stringers desirable for cars subjected to heavy loads handled on lift trucks with an increase in the weight of a 40-ft. 6 in. car of about 440 lb.; alternate side-sill arrangements one of which permits the removal and replacement of floor boards without disturbing the inside lining at a weight increase of about 150 lb.; and floor boards of thickness increased as desired.

The committee recommends for letter-ballot action that Manual page C-28D show four intermittent 1-in. welds on the draft-key retainer lock instead of 4½ in. continuous welds on each side.

The committee also recommends for letter-ballot action that Manual sheets C-10 and C-10B and the figures pertaining to the splicing of steel center sills referred to therein be revised to clarify the intent and to provide for the repair reinforcing of channel type steel center sills by welding.

High-Speed Freight-Truck Study

The committee includes a tabulation of the results of the 1950 road-test program in the cooperative freight car truck and snubber research project conducted on the Illinois Central with the American Steel Foundries five-car service laboratory. Report No. f3800 summarizing the results of all road tests conducted during 1948, 1949 and 1950 is in preparation by the Mechanical Division Research office. It will also include investigations of solid-type journal-bearing performance, a roller-bearing research program, lateral action of freight-car trucks, accelerometer calibration and side-frame stresses, and studies of vibration in freight cars.

Laboratory studies of life expectancy of the snubbing devices and constructions showing satisfactory performance during the three-year road-test program will be carried out at the A.A.R. draft-gear laboratory at Purdue University.

Side Frames and Bolsters

During the past year 45 additional designs of truck side frames and 59 additional designs of truck bolsters have been approved and identification numbers assigned. Three additional side-frame patterns were approved under identification numbers previously assigned because the new patterns differ in no essential respect from those to which the numbers were originally assigned.

Changes have been made in the regulations governing applications for approval of side frames and bolsters. Two changes have been added to those which can be made in journal boxes under the approval of the base pattern design: (1) modifications in journal boxes to permit the use of cartridge-type roller-bearing units; and (2) change in the design of the journal box to provide a removable lower portion to facilitate wheel changing. The addition or removal of brackets for Creco double economy or Creco double equalized brake-beam safety guards and addition or removal of holes for brake-beam safety guard brackets for Buffalo, Grip Nut, Drexel, Creco double economy, or Creco double equalizer brackets, are included under the same provision with respect to bolsters. A change in side-bearing spacing within certain limits is also included. The revised regulations are recommended for inclusion, respectively, in truck bolster and truck side-frame specifications. This is proposed for letter-ballot action.

Helical Spring Tests

Service life tests of helical springs instigated in 1945-46 by a sub-committee of the Car Construction Committee had run five years at the January 31, 1951, report. The test consisted of 100 car sets of A.A.R. 1936 1⅝-in.-travel springs (T-1); 100 car sets of proposed 1944 1⅝-in.-travel springs (T-2); 100 car sets, 2-in.-travel springs (T-3); 10 car sets, 2½-in.-travel springs (T-4). The essential results of these tests are shown in the table.

SPRING FAILURES DURING THE FIVE-YEAR TEST OF RAILWAY SPRINGS FOR FREIGHT CARS

	T-1	T-2	T-3	T-4
Total failures:				
Outer coil	73	238	348	31
Inner coil	12	4	15	5
Cars still in service	93	83	82	10
Outer coil failures per 100 coils initially installed	4.87	14.87	17.40	19.37
Failure index with T-1 failures as unity	1	3.05	3.57	3.97

Service Test of Brake Beams

The 1949 and 1950 reports of the Car Construction Committee refer to a number of brake beams which have been applied on various cars for road service tests. These beams were designs by the brake-beam manufacturers' mechanical committee and represented both the Unit type and brake-hanger type.* Periodical inspection of these beams will be continued. The progress of the tests after approximately three years of service is as follows:

Brake-beam A.A.R. designation No. 3	101	102	103	104	105	501	502	503
No. of beams applied 48	48	48	48	48	48	24	46	22
No. of beams removed since beginning of test due to failure of beam 1	4	2	3	12	2	0	1	0

Certified Brake-Beam Repair Specification

The committee has prepared a set of specifications proposed for the repairs to certified brake beams for freight cars which it recommends for submission to letter ballot. The specification covers dismantling, inspection and reconditioning of parts, assembly, testing, and marking.

Brake Beams for Special Freight Cars

All applications from manufacturers for approval of brake beams for application to cars of special construction on which standard beams cannot be used are to be submitted to the secretary's office to be passed on by the subcommittee on brake beams for approval. If approved, a certificate number will be assigned and all tests waived where the design is similar to designs already approved. Provisions for making the beams are also specified.

Stenciling for Special Equipment on Refrigerator Cars

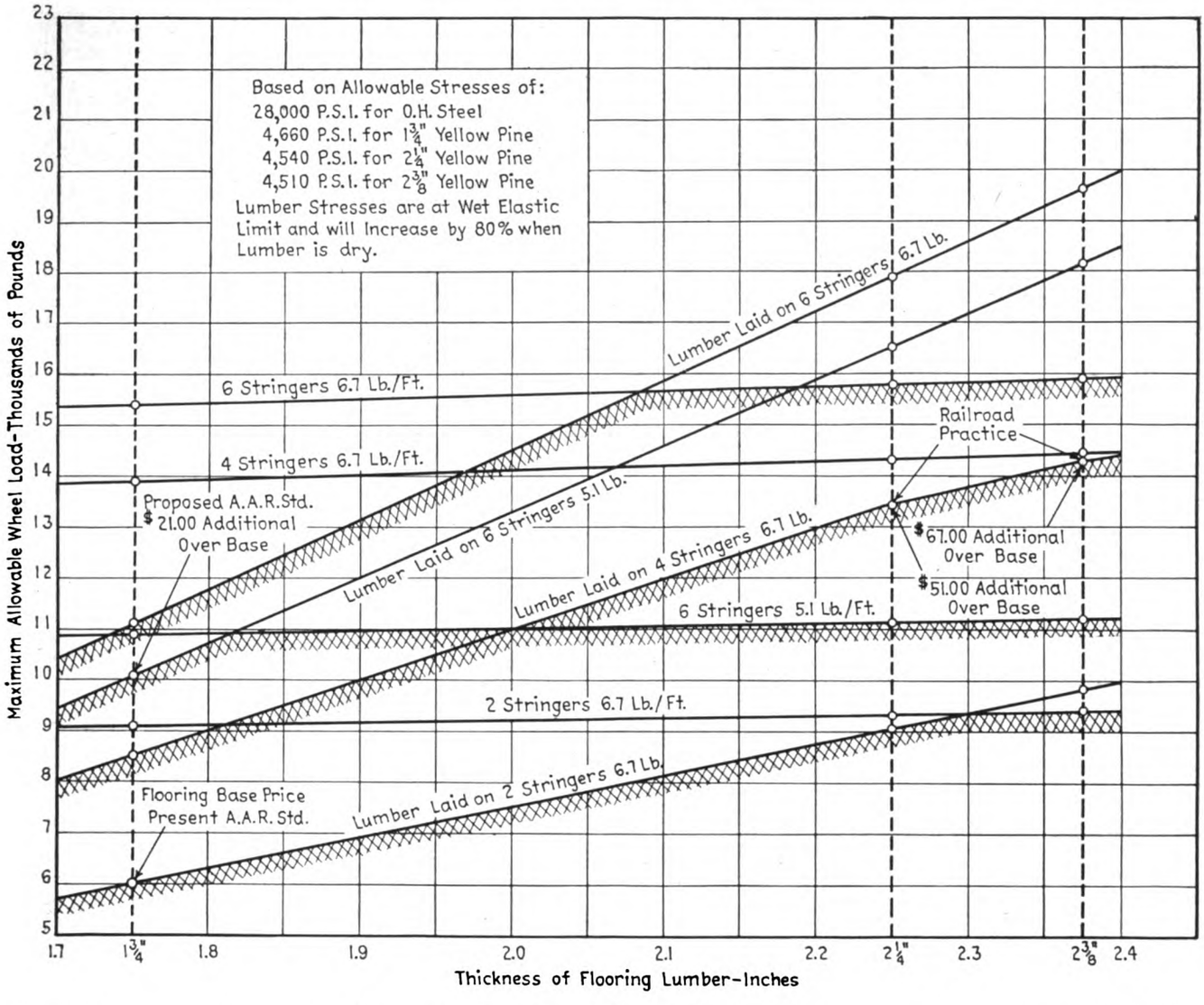
Operating men find it difficult to read stenciling on refrigerator cars for special equipment such as fans, stage icing, convertible bunkers, etc., in the upper left-hand corner of the car. The committee proposes for letter-ballot action that Manual page L-39-B be revised to show special stenciling to the left of the car number.

Strength of Car Floors

There is still a large railroad ownership of box cars having 1¾-in. wood flooring with only one longitudinal floor support between the side sill and center sill; numerous other cars with one floor stringer and 2¼-in. or 2⅝-in. wood flooring; and many cars have the present standard A.A.R. floor consisting of 1¾-in. flooring with two longitudinal floor stringers on each side of the center sill. All these combinations have been found lacking in sufficient strength for present-day heavy loading practices.

Various expedients have been advanced temporarily to correct these deficiencies. Some car owners have laid an auxiliary ¾-in. floor diagonally over the top of the present 1¾-in. floor. An addi-

* These beams are described in the 1949 committee report.



The shaded curves are the strengths of the combination of floor thickness and stringers under a 50-ton box car 40 ft. 6 in long inside, with a crosstie at the center of the door opening, continuous stringers and yellow pine lumber. Stringer spans are 44⅛ in., determined by crosstie spacing. At door opening the stringer span is 33 in., increasing board strength about 10 per cent and stringer strength about 30 per cent. No allowances for wear or dynamic load is included.

Diagram showing the effect on strength of freight-car floors of changing the lumber thickness on various stringer combinations

tional floor stringer has been added, making two on each side of the center sill. In the case of the car with the 2¼-in. or 2⅜-in. floor, this has merit, but with the 1¾-in. floor it still does not create a trouble-free floor. The addition of a perforated steel plate, extending from door to door, has materially improved the condition at the doorways where most of the damage occurs, but it is not the final answer.

Special steel channel floors, although affording relief from ordinary floor weakness, are quite expensive. A wood floor over stringers should last at least five years; the life of the steel or combination of wood and steel should be over twice that; but the price is many times that of the wood floor.

Many tests were conducted at the plant of the Pullman-Standard Car Manufacturing Company on the strength of different combinations of wood floor thickness and steel floor stringers. These proved to be erratic. For subsequent tests the fixture on which the test floors were mounted was rebuilt with underframe members spaced more realistically to represent the actual dimensions of a box car. The loads were applied in the direction that would occur on the car. By that is meant on the short 3-ft. span the wheel load was placed parallel to the length of the floor board such as would take place in the doorway of a car. In the panels where the cross-members were spaced 4 ft. apart, the wheel load was applied longitudinally of the car as if a lift truck were running between the crossbearer and the bolster.

The effect on strength of changing the lumber thickness on the various stringer combinations is shown in the accompanying graph.

The following basic facts are presented as a result of the tests conducted and calculations made: (1) The use of fir flooring versus yellow pine (based at 100 per cent) reduces lumber strength to 73 per cent; (2) the use of fir flooring versus yellow pine reduces floor stringer strength to 99 per cent; (3) the use of high-strength steel (similar section and strength as open-hearth but reduced thickness) versus open-hearth steel reduces lumber strength to 75 per cent; (4) the use of high-strength steel (similar section and strength as open-hearth but reduced thickness) versus open-hearth steel maintains stringer strength at 100 per cent; (5) the use of high-strength steel versus open-hearth steel (equal sections) floor stringers keeps lumber strength at 100 per cent; (6) the use of high-strength steel versus open-hearth steel (equal sections) floor stringers increases stringer strength to 164 per cent; (7) non-continuous stringers versus continuous stringers reduces stringer strength to 64 per cent; (8) non-continuous stringers versus continuous stringers reduces lumber strength to 56 per cent; (9) removing crosstie at center line of car reduces stringer

strength to 64 per cent; and (10) removing cross-tie at center line of car reduces lumber strength to 69 per cent.

From the data submitted, it is apparent that flooring of substantial strength is obtained with a 2⅝-in. wood floor laid on four 3-in. 6.7-lb. floor stringers (two each side of center sill) for an approximate additional expenditure over standard A.A.R. construction of $67 per car set. Several railroads are using four 4-in. 8.2-lb. Z floor stringers (two each side of center sill) to further increase floor strength.

Welding Cast Steel

A procedure for welding high-tensile steel castings has been approved by the Committee on Car Construction and the Committee on Couplers and Draft Gears. The joint subcommittee has prepared specific suggestions for modifications of coupler specifications and reclamation practices shown in Sec. C of the Manual and recommends, for submission to letter ballot, that a new Sec. D be added to the fusion welding and bronze welding limits and regulations (Manual pages L-3 to L-8F and Interchange Rule 3).

Passenger-Car Designations

The committee has reviewed the classifications for passenger cars shown in Section L of the Manual and considered changes recommended by the American Railway Car Institute. It recommends for submission to letter ballot changes in the designations and definitions of passenger-train cars to eliminate portions pertaining to equipment no longer in use and to simplify definitions.

Insect Infestation of Box Cars

The railroads have been requested to improve their car inspection and cleaning programs to comply with recommended standards for openings at bottom of side linings of box cars, for removal of debris and infestation from behind end linings of box cars and to consider possible redesign of box cars to eliminate spaces behind linings which are not self clearing. Information developed by a questionnaire sent to member roads by the Mechanical Division has been made available to the joint subcommittee. This includes various methods employed by individual railroads to deal with infestation of box cars, particularly as to the use of Fiberglas and other materials behind end linings.

The Car Construction Committee is of the opinion that an opening should be left at top and bottom of side lining so that the space behind it can be thoroughly cleaned. The top lining board should be left open only where there is a clear opening from top to bottom between the inside lining and outside lining. The subject is still under active consideration.

The members of the committee are J. A. Gower (chairman), assistant mechanical engineer, Pennsylvania; R. B. Winship, mechanical engineer, Canadian National; J. McMullen, consulting engineer, Erie; R. D. Bryan, mechanical assistant, Santa Fe; R. H. Graff, assistant engineer, car equipment, New York Central system; F. J. Herter, engineer car construction, Chesapeake & Ohio; H. L. Holland, assistant mechanical engineer, Baltimore & Ohio; N. A. Passur, engineer car construction, Southern Pacific; M. C. Haber, general mechanical engineer, Union Pacific; F. G. Moody, superintendent car department, Northern Pacific; K. H. Carpenter, superintendent car department, Lackawanna; W. A. Pownall, assistant to general superintendent motive power, Wabash; W. F. Kascal, mechanical superintendent Texas & Pacific.

Discussion

H. D. Fenske, assistant vice-president, Great Lakes Steel Corporation, in commenting on the freight-car-floor tests reported by the committee, said that these are static load tests and are not representative of the dynamic loads which car floors receive in service. Last summer, he said, dynamic tests were made at Altoona, Pa., by the Pennsylvania, and he suggested that the committee make dynamic tests of its own. He said that the cost and expense of car floors are relative and that the comparative economics of the steel and wood floors must be determined by a comparison of the total cost over the life of the car.

Cyrus J. Holland, president, Holland Company, said that the truck tests which were conducted by the committee during 1948, '49 and '50 have shown the necessity for long-travel springs. He reviewed the history of A.A.R. spring devlopments, including the 1915 standard 1-11/16-in. travel spring; the 1936 spring with 1⅝ in. travel; the 2½-in. travel spring, and the 3-1/16-in. travel spring of 1947, and the 3-11/16-in. travel spring of 1948. Thus, he pointed out, there are in use today five different designs of outer and five different designs of inner coil. This, he thought, should be simplified. He briefly described the Holland Constant Effective Static Deflection spring. This is a spring, the outer coil of which is made of a specially tapered bar with which is used a conventional inner coil helical spring. This spring, he said, will carry any load from empty to fully loaded car. With it, he said, it would be unnecessary to have special cars assigned to high-speed merchandise service with lighter capacity spring groups. This spring, he said, was tested in the 1950 road tests of the Cooperative Freight Car and Snubber Research program on several runs which demonstrated that it gave a satisfactory ride for the 169,000-lb. load up to 65 m.p.h., the 145,000-lb. load up to 90 m.p.h., and gave the lowest number of .5G and .75G shocks under the light load up to 90 m.p.h. of any comparable tests. Mr. Holland suggested that the subcommittee on springs investigate the benefits that could be attained by the use of this spring, which, he said, can be used in place of the present standard springs for reducing the number of spring designs needed.

(*The report was accepted and referred to letter ballot.*)

Lubrication of Cars and Locomotives

It has been decided that until it may be possible to formulate an A.A.R. specification for journal roller-bearing greases, it would be entirely consistent to approve certain greases which meet specified requirements considered necessary by your committee and which would pass compatibility tests. On the basis, the following greases have now been approved: Lubrico M-1, Special, the Master Lubricants Company; H-927 Non-Fluid Oil, the New York & New Jersey Lubricant Co.; No. 979 Roller Bearing Grease, the Texas Company.

Recommendation has been forwarded to the arbitration Committee to eliminate the present note following Sec. (k), Interchange Rule 66-A and, in lieu thereof, including the current list of approved greases for lubricating journal roller bearings.

Journal-Box Lids

Since the last annual meeting, the Joint Subcommittee on Journal-Box Lids has recommended that certificates of approval be granted for seven lids of the 5-in. by 9-in. and 5½-in. by 10-in. sizes, and 5 lids of the 6-in. by 12-in. size. Certificates have been granted and the lids shown in the list of Approved Journal Box Lids issued periodically by the secretary. Of these, 12 lids changes were required in 3 before approvals were granted.

Six requests for minor changes in design under existing certificates were granted. Two similar requests were rejected as the changes requested were such that parts manufactured under the new drawings would not be interchangeable with parts manufactured under drawings included in the original certificate of approval.

The subcommittee is also active in an effort to have lid manufacturers submit lids, in the 6½-in. by 12-in. size for approval in order that member roads may comply with Interchange Rule 3, Sec. j (3), which reads as follows: "Journal-box lids complying with A.A.R. Specifications for Journal-Box Lids as revised in 1947 and having A.A.R. Certificate of Approval are required on all cars built new or rebuilt after January 1950, from owners."

At a meeting on June 22, 1949, the committee agreed to conduct a series of vibration tests on journal-box lids to obtain information on the relative wear of the lid eyes, hinge pins and the holes and lug faces of the box.

Tests of Journal-Box Closures

Service tests of various combinations of journal-box closures have been continuing. One road which is testing 50 cars having the front face of the journal box planed smooth, journal-box hinge lugs in good condition and journal box equipped with deep-flange lid, reports that from the time of such installations in September 1949 until February 9, 1951 (date of reporting), no hot boxes have been experienced on any of these cars. In addition, an analysis of the waste in these boxes was made on three different occasions during this period and the highest moisture content was 1.84 per-

cent and the highest impurities content was 1.24 percent. On the basis of this performance, a suggestion was before the committee to recommend a requirement that the front face of journal boxes on all cars built new be planed smooth and that the hinge lug be equipped with wear plates both on the face and in the hinge-pin hole.

The committee felt that with close checking at the manufacturing plants, truck sides with integral journal boxes, or separable boxes, can be obtained with face within the present tolerances of 1/32 in., or even closer, which are considered satisfactory for freight service.

The following packing-retainer devices have been approved for roads desiring to use them; Hold-Rite packing retainer NP-8, 9 and 10, 11 and 12, Spring Packing Company; Modern Packing Keeper 8-9-10-11-12, Modern Railway Devices Company; Union waste retainer 9, 10, 11, Union Spring & Manufacturing Co.; Flex-Pak package-type waste container, 5 in. by 9 in., 5½ in. by 10 in., 6 in. by 11 in., the Hudson Company.

Quite a number of installations have been made by an eastern rialroad of the so-called "Hogan Anti-Waste Roll Ledge." The committee has arranged for inspections to be made of such installations and also to obtain data, where possible, regarding the performance of cars so equipped.

Hot-Box Statistics

Effective July 1, 1950, the General Committee directed that information again be collected covering the number of freight cars set off between division terminals because of hot boxes, and the number of miles run per hot box set off. The tabulation of this information again was considered necessary because of the number of hot boxes occurring last summer.

While the committee feels this basis will not permit consistent comparison between a high-speed, multiple-track railroad and a slower-speed light-traffic railroad, it will nevertheless afford a basis of comparison by each railroad with its own former performance and stimulate action for improvement by roads which might not have as good a performance as previously. The reporting form has been modified, however, so as to require the least amount of data from the reporting roads necessary for this report.

During the year a series of colored motion pictures were taken at the Indianapolis Lubrication Laboratory to record waste-pack displacements within the journal box after overnight freezing down at the —15 deg. F temperature range.

The Mechanical Inspection Department has been directed to obtain samples of journal-box packing in use by the railroads, private car owners, car builders and contract repair shops, and to arrange for the necessary laboratory analyses to determine if packing meets all the requirements of the specifications.

Axle Stop Dust Guard

A device known as the Axle Stop Dust Guard is intended to prevent unseating the journal bearing from the journal of freight or passenger cars or locomotive tenders, through rough switching or application of brakes. The committee has agreed to observe the performance of this device which has been installed in cars and locomotives of certain roads represented on the committee.

On the basis of the information and experience established up to the present, the principle involved in this device appears to have possibilities which may eliminate some of the causes of lubrication failures. If and when additional installations are made by interested roads, however, more experience in connection with the use of this device can be obtained.

Cotton Fabric Dust Guards

Under date of October 19, 1950, the U. S. Department of Agriculture advised that one of its research laboratories had developed a means of weaving an abnormally dense cotton fabric and that a number of thicknesses of this type fabric had been fabricated into a dust guard which might be acceptable as an alternate for present designs of dust guards in service.

Test samples were obtained of these cotton fabric dust guards and submitted to laboratory tests, three of the guards having the plies stitched together and three stapled with rust-resistant staples. Tests showed that both guards mushroomed at the axle opening, and the staple guard buckled at the corner and would have eventually turned around in the pocket. Both guards show indications of fraying out at the axle opening, and the danger of the cotton strands becoming loose and entering the journal box is very apparent. This is receiving further consideration by the committee.

Mention was made of the National Dust Reflector Housings in the 1950 report of this committee. Trucks having National Dust Deflector Housings have now been installed in Merchants Dispatch Transportation Corporation cars Nos. 10990 to 10999, inclusive.

A.A.R. Lubrication Manual

The A.A.R. Lubrication Manual was adopted as standard in 1949 and became effective on January 1, 1950. Like all new publications regarding rules, standards and recommended practices, the first edition was by no means perfect. It was, however, a start in a matter of extreme importance to all railroads and all car owners.

A thorough revision has been proposed and after further consideration is given to this matter jointly by the Lubrication and Arbitration Committees, it is quite certain that we will have an improved publication which will be more definite insofar as standard details and recommended details are concerned, and which will be more useful to the railroads and the private car owners.

During the year, in collaboration with the Solid Bearing Manufacturers' Technical Advisory Committee, the subcommittee has carried out the authorized plan of conducting road tests of bearing design modifications, to be used in association with axles with and without end collars. A two-week's program, utilizing the American Steel Foundries five-car service laboratory, operated as a special train over Illinois Central rails between Clinton and Gillman, Ill., was underwritten by the Magnut Metal Corporation and the National Bearing Division, American Brake Shoe Company. The results of this road testing research program have been published by the Mechanical Research Office in two reports, as follows: Report No. f3000—Investigation of Railway Equipment Journal Bearing Performance, dated December 15, 1950; report No. f4000—Lateral Action of Freight Car Trucks, dated December 28, 1950.

These two progress reports have been distributed to the several interested committees and the Solid Bearing Manufacturers' Technical Advisory Group as information, but to date have not been made available for general distribution.

Iron-Back Journal Bearings

As indicated in several circular letters issued by the secretary of the Mechanical Division, a new type of journal bearing has been developed, designated the "Laudig" iron-back journal bearing. The purpose intended for this new type of journal bearing is to lessen the possibilities of journal failures caused by hot boxes.

Approval for service tests of 100 cars equipped with "Laudig" iron-back journal bearings in interchange service has been authorized, and total installations had been made to 87 cars at the time this report was printed.

Complete instructions with respect to the road service tests these journal bearings are contained in circular letter issued November 30, 1950, by the secretary of the Mechanical Division.

Journal-Lubricating Device

Essential details of the Empire journal lubricator are shown in the drawing. This design employs a pair of ball-bearing rollers (oil impervious composition) held against the bottom of the journal through spring tension (piano wire) to replace the conventional waste-pack. The rollers provide semi-bath mechanical lubrication. An oil seal of composition material to withstand the action of oil takes the place of the conventional dust guard.

Laboratory tests of this device have been made at the Indianapolis Lubrication Laboratory under the jurisdiction of the A.A.R. Mechanical Engineer and a report with respect to same has been furnished to your committee. The laboratory tests indicated that this lubricator can be rated as a satisfactory device for the lubrication of conventional railway solid journal bearings.

The committee has decided that road service tests of a sufficient number of these lubricators should be conducted to establish the mechanical reliability and overall economics of this device as a basis for possible approval of its use under cars in interchange.

Installations have been made in different types of cars on six railroads and representatives of the committee have arranged to make periodic inspections of such installations from time to time to determine their service performance. Up to the present time, however, no definite recommendations have been offered.

The report was signed by Chairman R. E. Coughlan, chief metallurgist and engineer tests, Chicago & North Western, E. H. Jenkins (vice-chairman), assistant general superintendent car equipment, western region, Canadian National; A. J. Pichetto, general air brake engineer, Illinois Central; D. C. Davis, lubrication supervisor, Santa Fe; M. A. Pinney, engineer of tests Pennsylvania; H. T. Rockwell, assistant engineer, New York Central; M. A. Hansen, engineer of research, Gulf, Mobile & Ohio; F. Fahland, research & standards engineer, Union Pacific; Robert Schey, general superintendent car department, Nickel Plate; L. N. Griffith, assistant mechanical engineer, Southern Pacific; W. R. Petry, chemist, Great Northern.

Discussion

G. R. Andersen, superintendent car department, C. & N. W., said that his road was planning for a lubrication test in which one half of the journal boxes of 100 hopper cars will be lubricated with a low-viscosity oil of high film strength and the other half of the journal boxes will be lubricated with the regular oil. These cars will be retained on the home line.

During the meeting several members, speaking on this and other reports, referred to the necessity of strict observance of the rules with respect to attention to journal bearings and the journal boxes. Failures to do this were emphasized as one of the causes of recurring hot-box trouble.

(*The report was accepted.*)

Hot Box Alarm Devices

The principal activity of the committee has been to review devices submitted by individuals and manufacturers, and continue observation of the devices undergoing road service tests. At a meeting on May 3, a suggestion was submitted for employing a bolometer, or electronic radiation type of detector. The bolometer would be located along the track and is supposed to indicate the presence of overheated journals on cars passing a given point. A subcommittee has been appointed to investigate the possibilities and economics of this device.

Road Service Test Program

Of the four hot box alarm systems or devices approved for road service demonstration, two remained in service during the past year. The following tabulation shows the results of the service tests of the two devices from the date of the original application to March 31, 1951.

Alarm equipment	Service months	True indications	False alarms	Possible False alarms	Failures	Equipment defect
Pennsylvania cartridge	59	12	16	1	4	37
Magnus Metal Twin Plex	52	3*	1	0	0	17

* In the 1950 report these three instances were listed under "Failures." After review of reports covering these cases, the committee changed the classification as listed above on the premise that the records showed in all cases at least one of the bombs was discharged, but train crew failed to detect. Both tests were erminated during the past year.

	Number of cases 39,000, friction bearings	19,960 roller bearings	Total
(1) One or both alarm cartridges functioned, noted by train crews or others, overheated bearing found and proper action taken	15	5	20
(2) Overheated bearing found by inspectors at station stops; one of both alarms functioned in each case, but no action taken by train crew	28	3	31
In most of these cases bearing was in process of overheating with alarm cartridges only partially discharged when discovered. In at least 11 cases both alarms had fully discharged, giving train crews full warning			
(3) False alarms: Noted by train crew, 1; by test engineer at station stop, 1	0	2	2
In both of above cases journals had obsolete odor cartridge only.			
(4) Failure to function—bearing found overheated at station stop. Obsolete smoke and odor cartridges	0	1	1
Total on Trains en Route	43	11	54

(Four appendixes included with the report gave complete data on the service results on both devices.—EDITOR)

Member-Road Service Experienced

The New York Central furnished the following report of experience on trains en route with the Twin Plex Hot Box Alarm:

In furnishing the committee wih the above statistics it was stated: "There might have been circumstances under Item (2) in which the train crew apparently failed to take any action. The fact that in no case were the consequences serious would indicate that failure to take action may have been prompted by the knowledge that train was sufficiently close to a scheduled stopping point to make such action unnecessary.

"In addition to reports covering trains, as summarized above, a substantial number of reports were received listing partly discharged or leaking alarm cartridges found on cars at terminals and in yards. These are not included here because complete information was lacking in many cases as to whether the bearings in which these leaking or partly discharged alarm cartridges were found showed evidence of overheating or not. This was difficult to determine because Satco lining metal does not begin to melt until it reaches 585°F. Therefore a bearing might have been heated to say 450°F., well above the 350°F. temperature at which the alarm discharges, and yet when cold show no superficial evidence of having been overheated. Unfortunately, most of these bearings were destroyed before the question of whether they had been overheated could be determined to the satisfaction of all concerned." (A detailed record of 59 cases was included in an appendix.—EDITOR)

The Fenwal Journ-A-Larm System

As of August 20, 1950, Southern Pacific has had 185 cars, including sleepers, operating with Fenwal Journ-A-Larm system. Eighty-nine of these cars have been in service since May 1, 1950. All of these cars are equipped with roller bearings.

A number of false hot-journal alarm indications have been experienced since May 1950. These false indications were not confined to any particular train or territory, nor were they confined to any particular type of car. The majority of false alarms were caused by (a.) defective control switches on the alarm control, (b.) defective operation of timers operating the solenoid alarm valves, and (c.) internal breaking of leads inside the head of the thermoswitch. A relatively few other defects resulted in false alarms.

The experience gained with the Fenwal system for the past year has revealed certain weaknesses in the present system. These weaknesses could be determined only by thorough and continued use of the device in actual service on a large number of cars. The manufacturer has initiated a development program for the purpose of providing a basically new system for detection of overheated roller-bearing journals. The changes will be principally in the alarm panel located in the car electric locker and the thermoswitches. The present car-journal alarm wiring will remain practically unchanged. The circuit arrangement for the new system will be a normally open circuit with an automatic checking feature. About 10 or 12 cars will be equipped with the new device later in 1951 for road service tests.

On February 15, 1951, the journal alarm system functioned as intended indicating a hot journal on a sleeping car on Train 3 at Planeport, Texas. It was necessary to cut the car out of the train at El Paso approximately six miles from Planeport.

The Fenwal Jour-A-Larm system employed by the Southern Pacific is generally classified as a relatively expensive, electric type, applicable to passenger cars only. It is obvious that this device is still in the development stage, but that progress is being made in overcoming some of the service defects encountered in the original installations of the device on this railroad.

Members of the committee are J. R. Jackson (chairman), mechanical engineer, Mechanical Division, A.A.R.; M. A. Pinney, engineer of tests, Pennsylvania; H. L. Holland, assistant mechanical engineer, Baltimore & Ohio; J. Stair, Jr., electrical engineer, Pennsylvania; H. T. Rockwell, assistant engineer, New York Central; L. H. Sultan, electrical engineer, Southern Pacific.

(*The report was accepted.*)

Coordinated Association Programs

Five mechanical associations and the A.A.R. Electrical Sections will hold meetings and exhibit at Chicago, September 17 to 19

BEGINNING Monday, September 17 the Coordinated Mechanical Associations and the Electric Sections, A.A.R. Mechanical and Engineering Divisions, will hold a three-day meeting in Chicago. The mechanical associations are the Air Brake, Master Boiler Makers', Car Department Officers', Fuel and Traveling Engineers and Locomotive Maintenance Officers. The meetings of these five groups will be held at the Hotel Sherman and the meetings of the Electrical Sections, with the exception of a joint meeting with the L.M.O.A., will be held at the Hotel La Salle. There will be an exhibit of mechanical products at the Hotel Sherman under the auspices of the Allied Railway Supply Association, Inc. All of the mechanical associations have arranged their programs so that the afternoon of Tuesday, September 18, will be free for the members to inspect exhibits.

The officers of the coordinating committee of the Coordinated Mechanical Associations consisting of the presidents and secretaries of the railway associations and the exhibiting organization are: Chairman, A. K. Galloway, general superintendent motive power and equipment, B. & O.; vice-chairman, J. P. Morris, general manager, mechanical department, A.T. & S.F.; vice-chairman, George Bohannon, chief mechanical officer, C. & N. W.; secretary, C. F. Weil, American Brake Shoe Co. B. S. Johnson of W. H. Miner, Inc., is president of the Allied Railway Supply Association and C. F. Weil is secretary-treasurer of the supply association which, this year, is in charge of the exhibit. The programs of the several associations appear on this and following pages. Central Daylight Saving Time is given throughout.

Railway Fuel and Traveling Engineers' Association

MONDAY, SEPTEMBER 17

10 A.M.

Address by President G. E. Anderson, general fuel supervisor, Great Northern

Coal—Steam Locomotives, by C. M. Moddrell, supervisor fuel and locomotive performance, Northern Pacific

Locomotive Fuel Oil, by T. J. Conway, fuel supervisor, Texas & Pacific

2 P.M.

Employee and Public Relations on the Railroads, by L. W. Horning, vice-president personnel and public relations, New York Central system

Passenger Train and Freight Train Handling—Dynamic Braking, by F. T. McClure, general supervisor air brakes, Atchison, Topeka & Santa Fe (In joint meeting with Air Brake Association)

Water Treatment—Steam and Diesel Locomotives, by I. C. Brown, chief water engineer, St. Louis-San Francisco

TUESDAY, SEPTEMBER 18

9 A.M.

Diesel Fuel Oil—Loss of Fuel, by O. D. Teeter, fuel supervisor, Denver & Rio Grande Western

Address by E. H. Davison, director, Bureau of Locomotive Inspection, I.C.C.

Operation of Fairbanks Morse Diesels, by R. D. Nicholson, road foreman, New York, New Haven & Hartford

Education of Locomotive Operating Personnel, by G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac

Avoidable Train Delays with Diesel Power, by W. H. Fortney, chief road foreman of engines, New York Central

WEDNESDAY, SEPTEMBER 19

9 A.M.

Operating Difficulties Encountered on Line of Road, by W. H. Powell, supervisor of locomotives, operation, Baltimore & Ohio

Gas Turbine Locomotives, by R. A. Williamson, manager, railroad rolling stock division, General Electric Co.

Steam Generators—Elesco and Clarkson Vapor, by F. Thomas, assistant to general superintendent of equipment—diesels, New York Central system

Election of officers

2 P.M.

Safety in Train Operation

Air Pollution, by Glenn Warner, fuel supervisor, Pere Marquette district, Chesapeake & Ohio

Air Brake Association

MONDAY, SEPTEMBER 17

10 A.M.

President's address
Secretary's report
Miscellaneous

Inspection and Testing of 24-RL Equipment—Central Air Brake Club, John Mattise (chairman) Chicago & North Western

2 P.M.

To Obtain a Higher Efficiency in Air Brake Service, S. L. Williams, Westinghouse Air Brake Co.

Freight and Passenger Train Handling and Dynamic Braking, F. T. McClure (chairman), Atchison, Topeka & Santa Fe (In joint meeting with Railway Fuel and Traveling Engineers' Association)

TUESDAY, SEPTEMBER 18

9 A.M.

Effects of Air Leakage in Freight Trains, by H. N. Sudduth, New York Air Brake Co.

Clasp Brake Maintenance, H. I. Tramblie (chairman), Chicago, Burlington & Quincy

Report of Approved Maintenance Practice Committee, F. W. Dell (chairman), Grand Trunk Western

WEDNESDAY, SEPTEMBER 19

9 A.M.

24-Rl Brake Equipment—St. Louis Air Brake Club, E. W. Erisman (chairman), Wabash

No. 6 Type of Brake Eqipment for Diesel Electric Switching Locomotives, Manhattan Air Brake Club, L. D. Hays (chairman), New York Central

Removal of Moisture from Yard Charging Plant Air, Pittsburgh Air Brake Club

2 P.M.

Unfinished business—Committee Reports
Election of officers
Presentation of Past President's badge

Car Department Officers' Association

MONDAY, SEPTEMBER 17

10 A.M.

Address by President J. A. Deppe, superintendent car department, Chicago, Milwaukee, St. Paul & Pacific

Address by J. P. Kiley, president, Chicago, Milwaukee, St. Paul & Pacific

Report on Wheel Shop Practices, by E. E. Packard, district master car repairer, Southern Pacific

2 P.M.

Report on A.A.R. Loading Rules. A. C. Bender, (chairman), joint supervisor car inspection, Cleveland Car Inspection Association

Report on Interchange and Billing for Car Repairs. J. J. Sheehan (chairman) supervisor car repair bills, Missouri Pacific

Report on Air-Conditioning Equipment—Operation and Maintenance, R. F. Dougherty (chairman), general electrical & air conditioning inspector, Union Pacific

TUESDAY, SEPTEMBER 18

9 A.M.

Report on Analysis of Train Yard Operations—Inspection and Maintenance of Air Brakes, W. B. Medill (chairman), master car repairer, Southern Pacific

Address by G. J. Willingham, director of personnel, Illinois Central

Report on Car Lubrication, K. H. Carpenter (chairman), superintendent car department, Delaware, Lackawanna & Western

WEDNESDAY, SEPTEMBER 19

9 A.M.

Report on Inspection, Conditioning and Repairing Cars for Higher Commodity Classification, T. E. Hart (chairman), chief car inspector, New York, Chicago & St. Louis

Report on Cleaning and Painting Materials for Refinishing Passenger Equipment, E. M. Driscoll (chairman), foreman painter, Chicago, Milwaukee, St. Paul & Pacific

Election of officers

Master Boiler Makers' Association

MONDAY, SEPTEMBER 17

9:15 A.M.

Message, Association President R. B. Barrett

Message, D. V. Gonder, assistant to vice-president, Canadian National

Topic No. 2—Procedure for the fabrication of all-welded locomotive, stationary and portable boilers. Advantages of all-welded boilers vs. riveted boilers as experienced to date, George M. Davies (chairman), assistant engineer, locomotive equipment, New York Central system

Message, Secretary-Treasurer A. F. Stiglmeier

2 P.M.

Report of the Executive Board

Topic No. 1—Fabrication and erection of modern stationary boilers, with moving pictures. Advantages of chemically descaling stationary and portable boilers, with moving pictures. Stanley F. Wentz (chairman), assistant supervisor of boilers, New York Central

TUESDAY, SEPTEMBER 18

9 A.M.

Message, J. P. Wadsworth, superintendent of safety, Canadian National

Topic No. 3—With the use of approved chemicals in locomotive feedwater for the purpose of reducing the blowdown and carrying higher solids in boiler water. What, if any, adverse and detrimental effects are experienced from these increased solids? F. E. Godwin, (chairman), mechanical inspector, Canadian National

Election of officers

Report Committee on Law

WEDNESDAY, SEPTEMBER 19

9:15 A.M.

Report Committee on Memorial

Message, Edward H. Davidson, director, Bureau of Locomotive Inspection, Interstate Commerce Commission

Topic No. 4—Proper procedure to be followed in the maintenance and testing of stationary and portable air reservoirs other than locomotives and cars. Care and maintenance of stationary and portable boilers. Harry C. Haviland (chairman), supervisor of boilers, New York Central

Topic No. 5—What effect do pounds, broken frames and stuck or gauled expansion shoes have on boiler maintenance. A. A. Edlund (chairman), assistant general boiler inspector, Chicago, Milwaukee, St. Paul & Pacific

2 P.M.

Report Committee on Resolution

Topic No. 6—Procedure for washing and testing steam generators on locomotives other than steam. What improvements can be made to abate corrosion on steam generator coils. What improvement can be made to abate electrolytic action and corrosion on heating boilers of electric locomotives. S. H. Christopherson (chairman), supervisor of boiler and welding inspection, New York, New Haven & Hartford

Locomotive Maintenance Officers' Association

MONDAY, SEPTEMBER 17
10 A.M.

Address by President P. H. Verd, superintendent motive power and equipment, Elgin, Joliet & Eastern

Address by F. K. Mitchell, manager of equipment, N.Y.C. system

2 P.M.

Report of Committee on Winterization of Diesel-Electric Locomotives, F. Thomas (chairman), assistant to general superintendent equipment—diesel-electric, New York Central system

Report of Committee on Personnel Training, E. V. Myers (chairman), superintendent, St. Louis-Southwestern

Report of Committee, Diesel Mechanical, L. I. Luthey (chairman), general supervisor of diesel engines, A. T. & S. F.

1. Air filters
2. Extension of inspection periods
3. Water and oil leaks

TUESDAY, SEPTEMBER 18
10 A.M.

Report of Committee on Shop Practices, C. H. Spence (chairman), superintendent of shops, Baltimore & Ohio

1. Repairing diesel locomotive trucks
2. Welding on diesel locomotive work
3. Servicing steam power at terminals

Report of Committee on Shop Tools, F. E. Molloy (chairman), superintendent of motive power, Southern Pacific

WEDNESDAY, SEPTEMBER 19
9 A.M.

Report of Committee on Diesel Material Reconditioning and Control, W. R. Sederquest (chairman) superintendent locomotive maintenance, New York, New Haven & Hartford

Report of Committee on Diesel Terminal Facilities, H. H. Niksch (chairman), master mechanic, Elgin, Joliet & Eastern

1. Centralized reconditioning facilities
2. Cleaning diesel locomotives
3. Wayside facilities

2 P.M.

Joint session with Mechanical Division, Electrical Section

Address by E. H. Davidson, director, Bureau of Locomotive Inspection, Interstate Commerce Commission

Report of Committee on Cleaning and Testing Electrical Equipment, W. P. Miller (chairman), superintendent diesel and motor car equipment, Chicago & North Western

Electrical Sections—A.A.R. Mechanical and Engineering Divisions

MONDAY, SEPTEMBER 17
10 A.M.

Address by H. F. Finnemore (chairman, Engineering Division), chief electrical engineer Canadian National

Address by L. C. Bowes (chairman, Mechanical Division), electrical engineer Chicago Rock Island & Pacific

Unfinished and new business (Mechanical)

Election of officers (Mechanical)

ENGINEERING DIVISION

Report Joint Committee Wire, Cable and Insulating Materials,

Report of Joint Committee on Power Supply

2 P.M.
ENGINEERING DIVISION

Report of Committee 2—Electrolysis

Report of Committee 3—Overhead Transmission and Catenary Construction

Report of Committee 9—Track and Third Rail Bonds

Report of Committee 10—Illumination

MECHANICAL DIVISION

Report of Committee on Application of Radio and Communicating Systems to Rolling Stock

Report of Joint Committee on Electrical Facilities and Practices for Repair Shops

Report of Committee on Wiring Diagrams for Rolling Stock

TUESDAY, SEPTEMBER 18
9 A.M.
ENGINEERING DIVISION

Unfinished business

New business

Report of Committee 11—Electric Heating

MECHANICAL DIVISION

Report of Joint Committee on Welding and Cutting

Report of Committee on Car Electrical Equipment

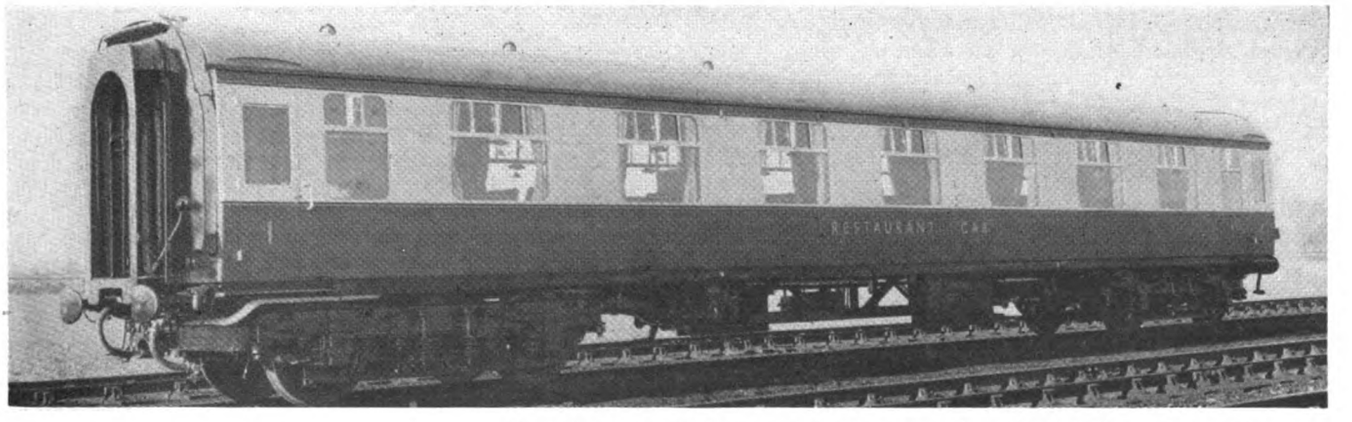
WEDNESDAY, SEPTEMBER 19
9 A.M.
MECHANICAL DIVISION

Report of Committee on Car Air-Conditioning Equipment

2 P.M.
MECHANICAL DIVISION

Report of Committee on Automotive and Electric Rolling Stock (In joint session with L. M. O. A.)

* * *



New standard all-steel passenger cars for the British Railways have automatic couplers with retractable side buffers for use with screw-coupling cars

ELECTRICAL SECTION



Two-unit 4,000-hp. diesel-electric locomotive hauling a passenger train up a 1.8 per cent grade in the Lehighton-Mauch Chunk area on the Lehigh Valley

Carbon Brushes Must Carry Peak Loads

High efficiency, uniform dependability and maintenance of optimum commutator condition are more important than long brush life

*By C. P. Turner**

THE 1,246-mile Lehigh Valley operates over some of the steepest mountain grades in the eastern United States, centered principally among the anthracite fields of Pennsylvania. Its 448 miles of main line between the Niagara frontier and New York City follow the winding course of the Susquehanna, Lehigh and Raritan Rivers for several hundred miles.

A primary problem which the engineering and operating personnel have had to solve arises from the constant punishment undergone by locomotives assigned to negotiate the curves not only at sea level, but up and down the steep grades. Following an exhaustive survey, Lehigh Valley management determined that operating expenses could be reduced considerably through conversion from a steam-powered railroad to one of diesel operation. This involved not only a complete change-over from traditional railroading but it meant huge capital outlays for new terminal and servicing facilities, as well as a re-education of personnel. Today, all main line freight and passenger service is fully dieselized, and it is expected that the operations will soon be 100 per cent dieselized.

A diesel-electric locomotive, due to the complexity of its mechanical-electrical system, discourages any inference that one part of it is more important than another. The finest locomotive power plant is of no value unless its power is delivered to the wheels. Consequently, close attention must be directed to the proper operation of traction motors. Dependable motor operation relies, to a great extent, on good commutation and brush performance.

*System Supervisor, Diesel Operation and Maintenance, Lehigh Valley

Locomotives on the Lehigh Valley are operating at either extreme of service most of the time; that is, they are either pulling at peak effort while climbing a grade, or coasting down the other side before reaching another upgrade. Either extreme taxes the abilities of the diesel-electrics and challenges the "feel" of the engineer and proves his ability in handling the controls with fine precision to coax the last ounce of power out of the locomotive. The fact that the Lehigh Valley roadbed has served as a proving ground for many other railroads in testing their diesel-electric locomotives over rugged terrain, is an indication of the robust topography traversed by the Lehigh and a decided victory for locomotives whose stamina makes such runs daily routine. With passenger and freight service totaling nearly four and a half million miles and another three and a half million miles of switching service annually, a concrete idea is provided of the enormity of the task of keeping 187 diesel-electric units running at high efficiency with an availability of some 93 per cent.

Despite the fact that freight trains are scheduled at speeds which only a few years ago were considered high even for passenger trains, the gap between passenger and freight train speeds is not narrowing to any great extent, due to passenger train speeds have risen almost proportionately with that of freight. Such a comparison further emphasizes the maximum performance demands placed on traction motor brushes that must function perfectly at high speeds, both under heavy pounding, and at peak loading. In proportion to the relative resistance of copper to carbon, traction motor brushes must carry current densities fifty to one hundred times in ratio to the armature winding, while rubbing on the commutator under a pressure of 9 to 12 lb. per brush, entirely without lubrication other than that provided by the brush itself. The surface speed reaches a peak of two miles a minute, yet there is practically no commutator wear.

There have been some instances of breakage and wear on brushes that have been more prevalent on the passenger locomotives than on the freight, though it would appear that the latter service is subject to greater stresses because of heavier loads. Some brush breakage has been experienced on the lead motor and the only plausible explanation is that, when the leading truck hits cross-overs and occasional wide rail joints at high speed, the resulting jolt causes the brushes to bounce excessively. The initial impact somewhat softens the blow for following trucks.

There have been occasional cases of the commutator wearing out-of-round on passenger locomotive motors without any apparent evidence of burning or copper pulling. This situation defied analysis for a while, but later corrected itself; thus, it was concluded that it was of an "epidemic" nature.

For the kind of operation the Lehigh Valley must live with, the selection of traction motor brushes has been simplified by the efforts extended by the manufacturer. Brushes now in use are strong to withstand high speed impacts and heavy hauling, yet at the same time, combine the required degree of commutating ability and proper friction coefficient to keep the commutators well polished. Precaution must be taken to see that the spring pressure is carefully adjusted and maintained to provide uniformly correct tension for good contact and resultant good commutation, at the same time holding the brush firmly to the commutator's surface with a minimum of jumping. Actual brush life does not constitute a primary essential. If the three essentials of high efficiency, uniform dependability, and maintenance of optimum commutator condition are achieved, reasonable brush mileage will follow.

No attempt has been made to restrict our use to any one manufacturer's brushes. Nevertheless, Grade AZY is the standard brush used on the D7, D17 and D27 type traction motors. This brush is longer-lived than previous specified grades.

It is unnecessary to establish a set schedule for brush changes on traction motors. Each locomotive unit receives an overall inspection every fifteen days, the condition and wear on the brushes being noted on the card affixed to each motor, and new brushes are installed when the old ones have outworn their usefulness.

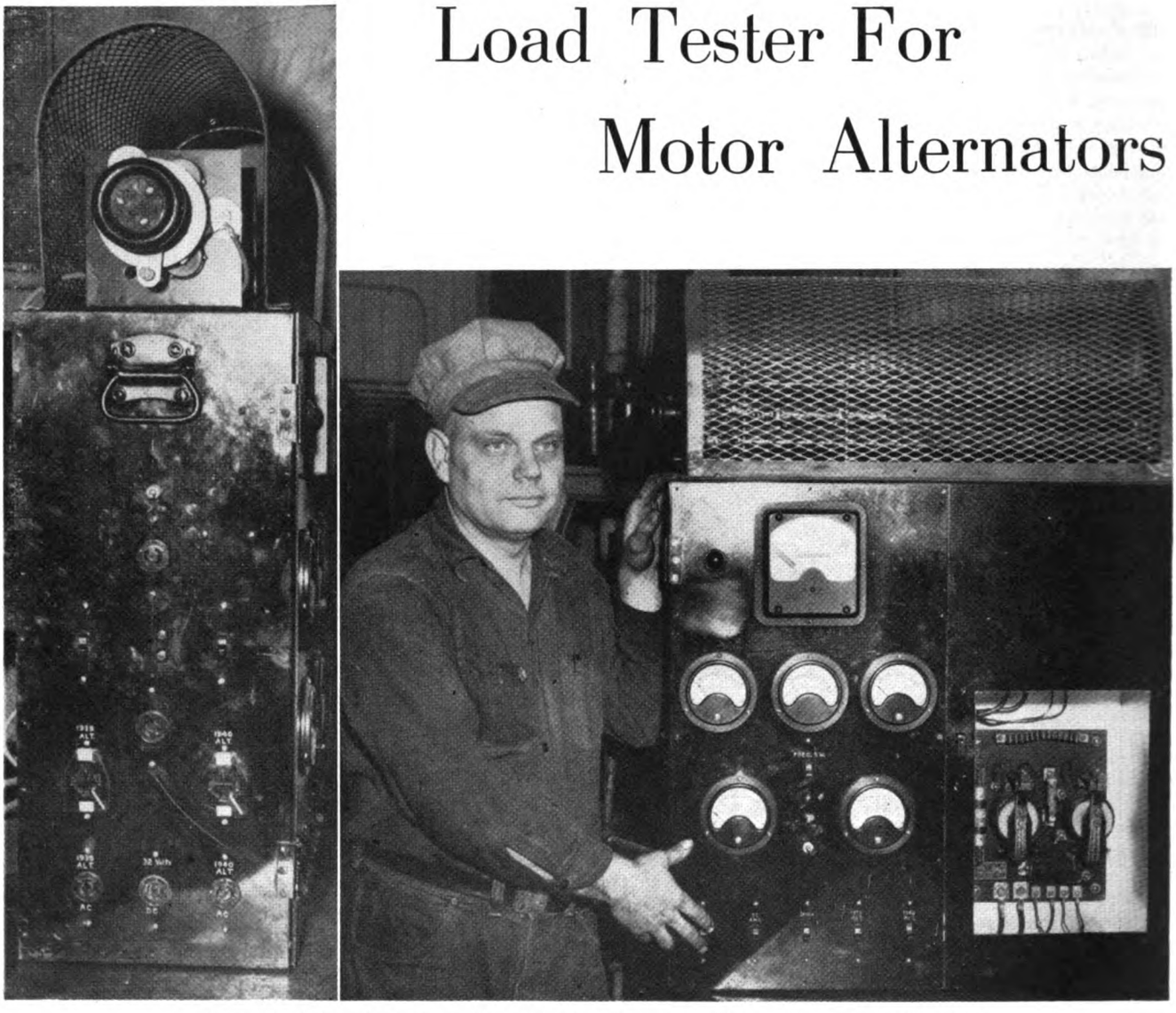
Coupled with defects revealed after careful inspection as well as taking full cognizance of the manufacturer's recommendations, the armature may be completely torn down, new windings installed, and commutator and brush holders reconditioned, and the motor then again subjected to a thorough shop test before being assigned for duty. Undercutting the micas is standard practice. Under normal conditions, the brushes protect the commutator against frictional wear as well as damage from sparking. With a uniform gloss over the entire commutator surface, with neither raw nor burned spots or any high resistance glaze, commutator wear will be negligible item of maintenance and machine depreciation.

The only reason traction motor brush performance is now so satisfactory and trouble-free is that brushes are now available that combine good commutator factor, uniform dependability and a minimum of mechanical and electrical losses. These qualities are further combined with the capacity for carrying continuous peak loads without excessive heating and with long brush mileage.



W. D. Taylor, electrical engineer, Central Region, Canadian National Railways, on the left, stands in front of the Canadian-built C.N.R. diesel-electric road locomotive exhibited at the American Institute of Electrical Engineers' Summer General Meeting with F. L. Jones, supervisor of diesel equipment, Central Region, in Toronto, Canada, June 25, 1951

Load Tester For Motor Alternators



Left: The left end of the cabinet, showing the receptacles used for connecting the power supply and the machines on test. Right: The author with his load test cabinet

*By K. F. Gluesing**

THE DEVICE illustrated was developed for making load tests on all types of Safety motor-alternators up to 2 kw. capacity. It was built by the author under the supervision of A. E. Lines, departmental foreman of electricians, Los Angeles General Shops, Southern Pacific.

The test set incorporates a 200,000-ohm ground detector, a frequency meter, a kilowatt meter, a d.c. ammeter, a d.c. voltmeter, an a.c. voltmeter, and an a.c. ammeter. The load for the alternator is a 2,250-watt, Allen Bradley variable resistance which is mounted on top of the cabinet.

Through the opening at the right of the cabinet may be seen one of the starters for the newer type motor-alternators. Immediately above it, but not visible, is a starter for the older model machines. These starters are used to start the machines under test.

Below the meters are control switches, and on the end of the cabinet are receptacles for receiving d.c. power and for connecting the machines under test.

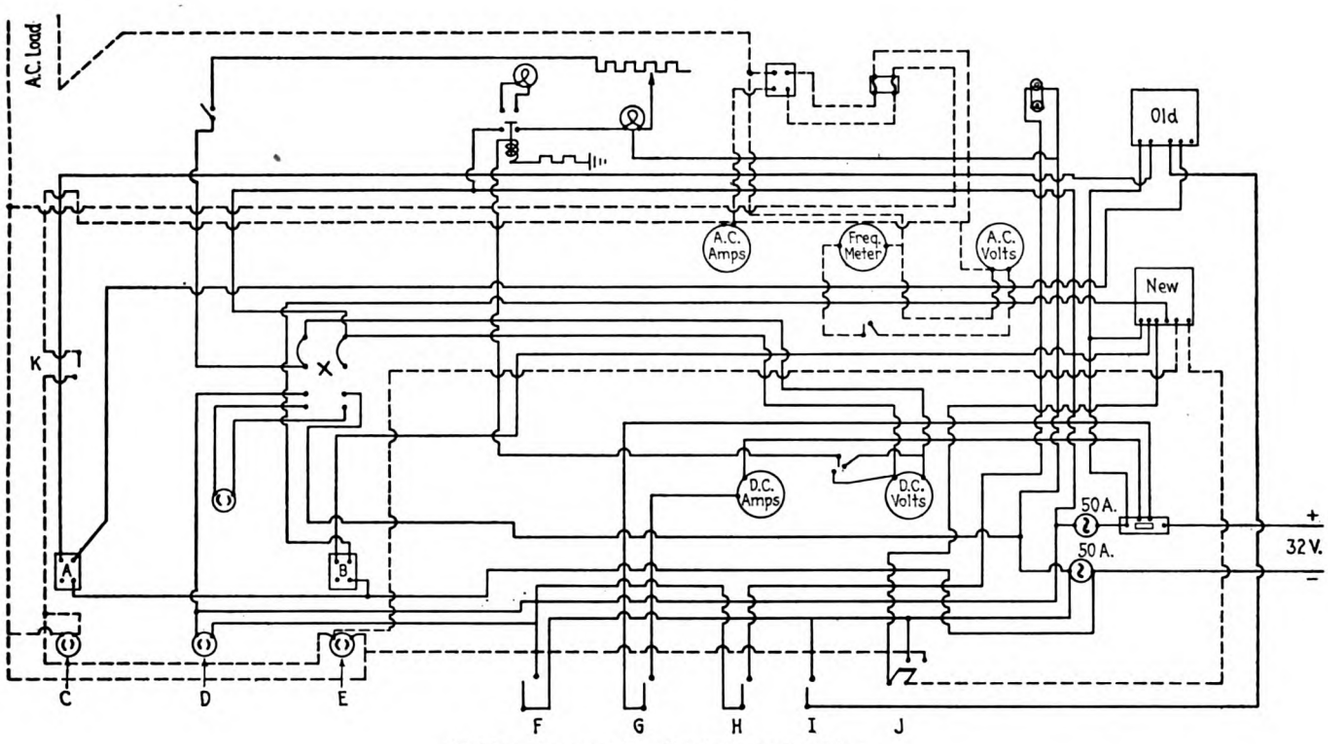
Referring to the diagram, 32-volt d.c. power is supplied to the receptable *D*. If a new type machine is to be tested, the a.c. terminals are connected to the load through receptacle *E*, and the d.c. terminals are plugged into receptacle *B*. Closing the switch *J* connects the d.c. end of the machine to the proper starter. Closing the switch *F* starts the machine. The a.c. load switch *K* is then closed and meter readings are taken while the machine is loaded on the rheostat.

The older type machines are connected to receptacles *A* and *C*, and are started by closing switches *I* and *F*.

By means of the double-pole, double-throw switch *X* on the d.c. voltmeter, it may be used to check the input voltage, as well as the rectifier output voltage and compensating resistor voltage drop.

The tester also has a separate circuit that is used to

* Electrician, Los Angeles General Shops, Southern Pacific Company, Los Angeles, Cal.



Wiring diagram for the load test cabinet

test all types of d.c. motors using full voltage or voltage in series with two 250-watt lamps. These lamps are used for testing series motors and are inserted into the circuit by leaving switch *F* open and closing switch *H*.

The device is portable, and can be taken from the bench to any part of the yards or shop. When used with a power factor meter with the a.c. car circuits as a load, it gives a true picture of the actual operating conditions of the alternator and fluorescent lighting on any tpye of car having such equipment.



General view of the Great Northern's Dale Street electrical repair shop in St. Paul, Minn.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

2 Troubles Do Not Happen-- They Are Caused*

In which the theory and practice of lubricating traction motor suspension bearings are explained

MOTIVE power maintenance departments are faced with the problem of trying to keep pace with fast growing fleets of diesel-electric locomotives. This is a very different job than in the days of the first lone diesel on a steam road. Then it was a case of getting the job done somehow with the existing steam facilities and manpower. A vacant roundhouse stall between two steamers, or the cinder pit and an untrucked box car, had to serve as a shop. The steam-minded shop man with his heavy tools faced the exacting needs of the diesel engine, and the strange electric drive.

Today many railroads are hard at work on this problem. They are providing special diesel shops, and studying the best ways and means of maintaining this new form of motive power. Their efforts are spurred by the fact that the diesel is one of the most valuable and expensive tools ever placed in the hands of railroad men. Its operating economy makes railroad dieselization possible. Its cost requires that it be used to the fullest extent. It must be kept available for hauling trains and producing revenue. On the other hand, maintenance costs must be kept low since they are an important part of operating expense.

Getting in the Groove

On many roads, the diesels have operated long enough for the "newness" to wear off. Occasional attention has been replaced by scheduled maintenance. The "run them 'til they fail" or "let's see what they can do" kind of operation, ending in road failures and costly repairs, has had its day. The progressive maintenance system is now in favor because of its good results on many roads. It is, however, giving way to the preventive maintenance program with its regular service inspections and scheduled overhauls. The big aim of this change is to balance the cost of maintenance against the cost of locomotive failures and keep the total as low as possible. Engines standing over pits or in the backshop cannot pull pay loads. They are not earning their keep.

There is much to learn about economic maintenance. Today there are as many ways to do the job as there are men with ability to see the challenge of the problems.

*This is the 2nd of a series of articles on maintenance of diesel-electrical equipment. This article is written by J. W. Teker and J. H. Kathman, both of the Motor Engineering Division, General Electric Company, Erie, Pa.

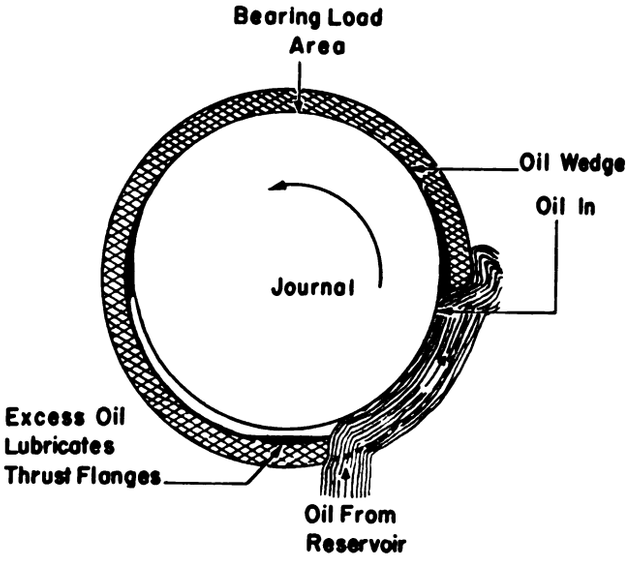


Fig. 1—Diagram of traction motor suspension bearing showing formation of oil wedge

Only as maintenance experience develops can more uniform practices be realized.

The Proving Ground

The diesel-electric locomotive is continually being improved. Its components are far from being standardized as yet. With each new design come features welcomed by the railroads to meet their changing problems. But to the maintenance people these variations of parts and requirements bring despair. Nevertheless, this group holds the key to the development of better motive power. It is the maintenance record that proves the worth of each feature.

As maintainer and designer work together, their efforts will be of great value to the railroads and locomotive builders alike. Maintenance experience brings out the need for changes and improvements. Often, these can be made on locomotives in operation as well as those being designed. Through modification programs existing power can be modernized to give operating benefits at once. Such programs, especially on large railroad systems, need careful coordination of instruction and effort by widely separated maintenance groups. Unless this is carried out in an orderly way, one group may apply a modification which the next group may remove, and some locomotives may be missed completely.

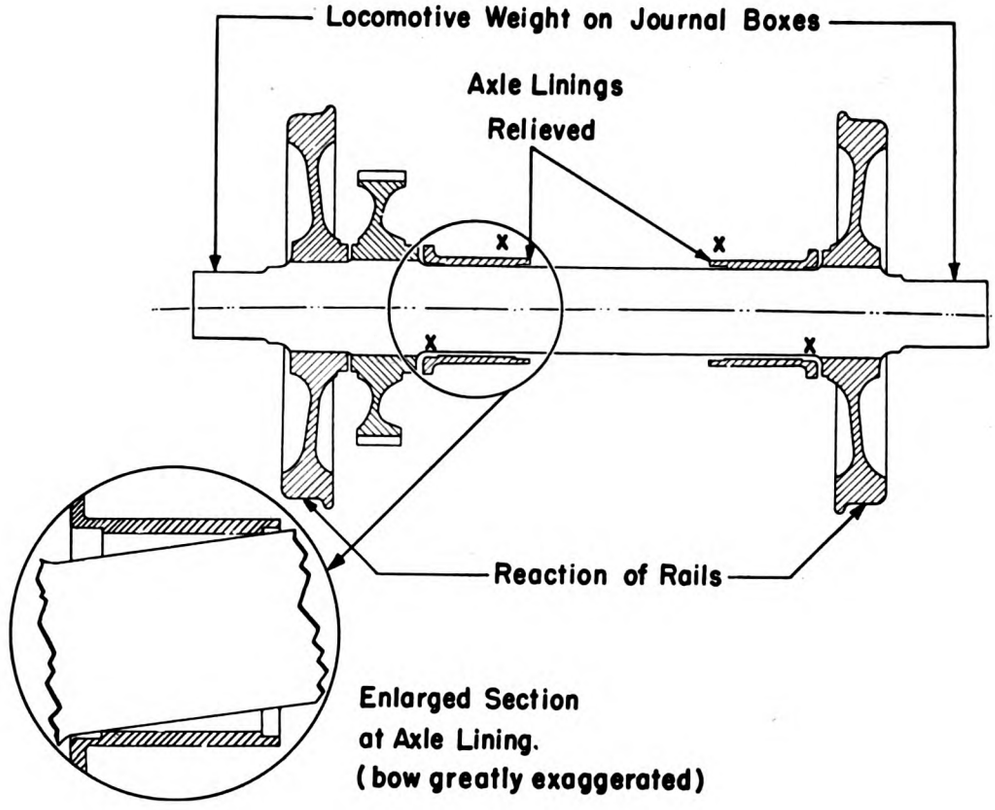


Fig. 2 — Diagrammatic sketch of axle loading showing reason for relief at ends of motor suspension bearings

"How" and "Why" to Help You "Do"

Maintenance recommendations and programs are based on the needs of the equipment. General instructions are issued by the builders to serve as a guide. In practice these are often modified to fit the actual operating conditions found in various types of service. We do not propose to add to these instructions. Rather, we will point out the reasons for them, based on simple descriptions of how the parts operate and what they do. With such knowledge a maintainer can do his job intelligently. Faults can then be located directly without wasting time on "cut-and-try" methods.

Troubles do not happen—they are caused. Therefore, every trouble offers the opportunity to discover its cause. When these causes are known, an understanding of the fundamentals involved makes it possible to set up a program of preventive action.

A maintainer who simply goes through the motion of his job without understanding the reason for what he is doing is very likely to become indifferent and sometimes to take unreasonable short cuts. As a result, he may fail to accomplish his purpose. An example is the case where lubricant intended for the gear case was put into the commutator chamber of the motor instead. The cover was then carefully latched shut, and the man went serenely on to his next job! The diesel-electric locomotive, divided into its separate systems and parts, is simple enough to be clearly understood. When the maintainer understands what these parts do, and how they operate, he feels a new confidence about his job. This enables him to work rapidly and surely, and constantly to improve his effectiveness.

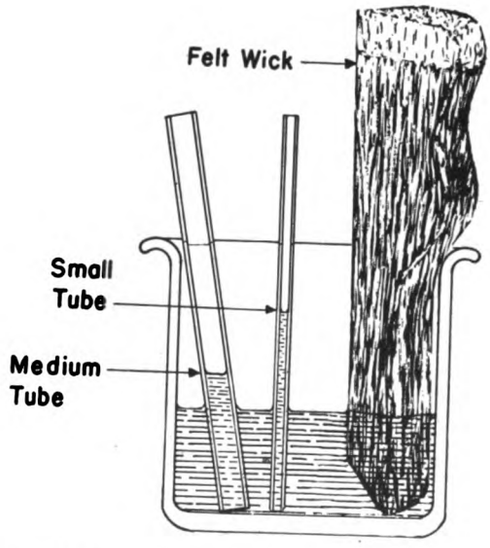


Fig. 3—Comparison of Capillary action

Lubrication

What It Is.—Any picture of the word "maintenance" ought to include an oil can, since lubrication plays an important part in maintaining any apparatus. When we think of lubricating electric machinery on diesel-electric locomotives, we must keep three things in mind:

1. Sleeve bearings.
2. Roller and ball bearings.
3. Gears.

Lubrication of roller and ball bearings and gears will be discussed in a subsequent article.

The job of the lubricant in a sleeve bearing is to keep the journal from rubbing and wearing. With oil lubrica-

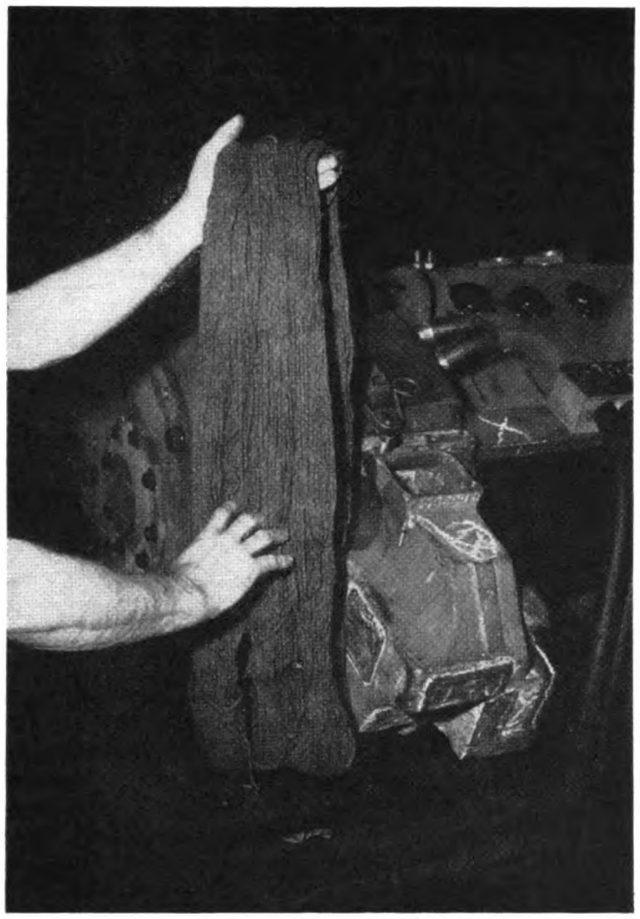


Fig. 4—Long-strand wool waste used for "wick" in axle cap bearings

tion, this is done by feeding the oil into an unloaded section of the bearing and developing an oil wedge. Traction motor suspension bearings, such as sketched in Fig. 1, are a common example of this.

How It Works.—As the journal turns in the bearing, it carries the oil into a smaller and smaller wedge space. The pressure on the oil becomes greater and greater until the entire bearing load is carried by the oil wedge. At its thinnest point, this oil wedge is a mere film. This makes the area immediately under the bearing load a devil's workshop when the oil is dirty or the journal is nicked. The trouble and cost of keeping oil clean is a mighty low price to pay for insurance against bearing failures. Periodical cleaning of oil reservoirs and renewing of oil is a big help. On traction motor suspension bearings, for example, this is easily done during wheel changes. The oil reservoirs should be periodically drained to get rid of water and sludge that settles in the bottom. Seals of felt or other material are used to keep dirt and water out of the bearing during operation; these seals should be kept in good condition. They can be readily renewed when necessary, at overhaul inspections or when the equipment is taken apart for other reasons. The old saying, "Cleanliness is next to Godliness" is certainly true of bearings and oil.

Motor Suspension Bearing.—The main place where the sleeve type of bearing is now used in diesel-electric locomotives is in the traction motor suspension bearings. Here it has a multitude of things to do:

1. It must support the weight of the motor on the rotating locomotive axle. This job would not be complicated if the axle were perfectly straight. Actually, it is slightly bowed due to the weight of the locomotive on the journal boxes, as shown in the sketch, Fig. 2.

Because of this, the axle lining is designed with a relief in the ends of the bore. Thus, the ends of the long linings will not cramp on this bowed axle at pressure points marked *X* in Fig. 2. This allows the bearing to seat itself to the axle gradually without the overheating and wiping that would occur at *X* if it were not relieved beforehand.

2. Besides the weight of the motor, the suspension bearings are loaded by gear and pinion forces needed to move or brake the train. These forces are called the gear reaction. They may be three or four times the load on the bearing due to the motor weight.

3. The suspension bearings must also keep the gear and pinion in proper mesh. To do this, they must accurately maintain the distance between the traction motor armature shaft and the locomotive axle.

4. Inadequate lubrication of a suspension bearing has

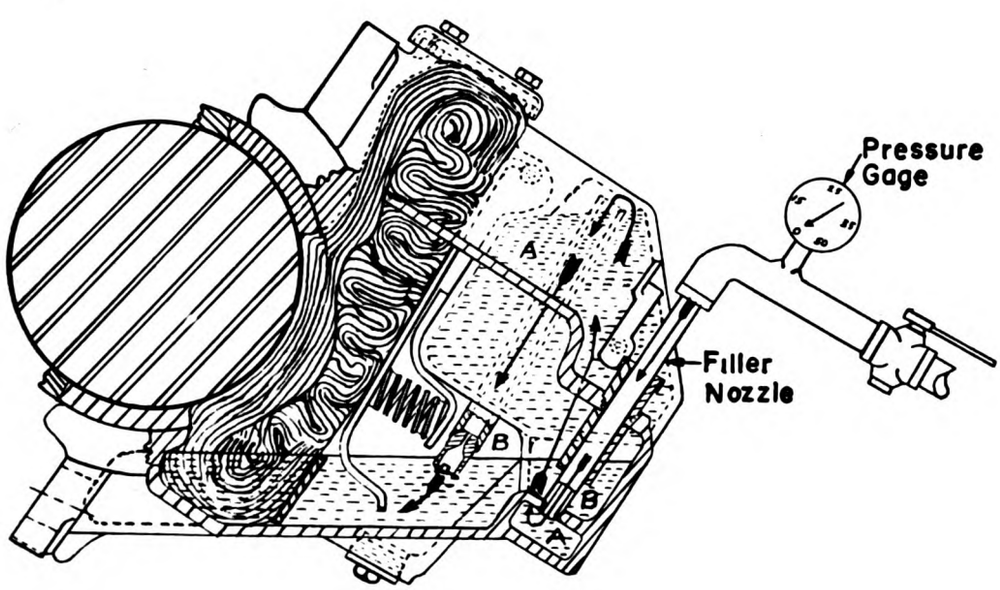


Fig. 5 — Traction motor axle cap showing wool waste packing

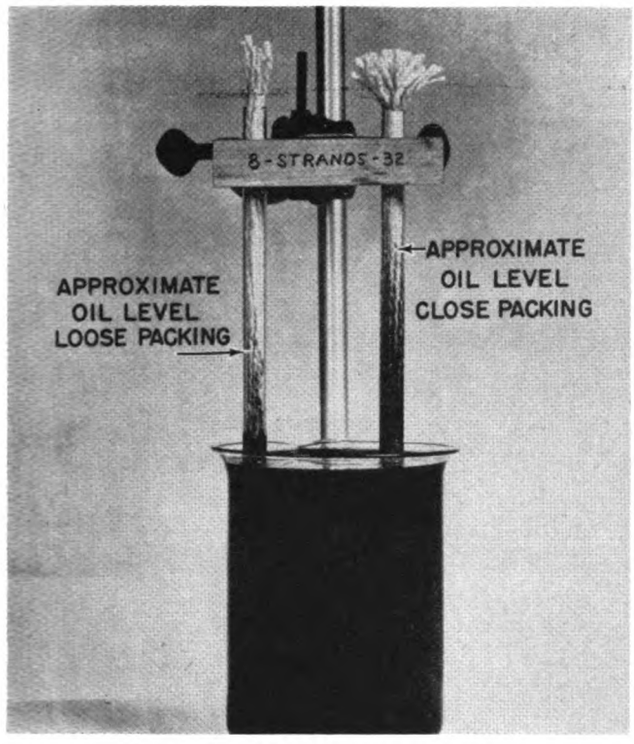


Fig. 6—Oil lifting power of loosely and tightly packed waste

many bad results. The thrust flanges of the linings take the worst beating because they are lubricated with only the excess oil from the sleeve portion of the lining. When these flanges wear, the traction motor can shift out of its proper position between wheels and cause interference troubles. This increased end play allows the motor to chuck back and forth between the wheels. The resulting impact blows batter the flanges and running gear.

Wicks and Waste.—It is of the greatest importance to keep these suspension bearings properly lubricated. The main part of this task falls to the wicks which feed the lubricating oil onto the journal. They deserve careful consideration. These wicks are either made up of loose strands of wool waste or formed pieces of wood felt. The waste and the felt, like any other wool material, consist of thousands of thin wool strands, matted together with very small air spaces between them. In the wick, these small air spaces form tubes in which the oil climbs from the reservoir up to the journal. This is called the capillary action of the oil in the tubes. It can be shown by placing a glass straw in a cup of oil. The oil will rise in the straw to a level of about $\frac{1}{8}$ in. above the surface of the oil in the cup. If a smaller diameter straw is placed in the same cup, the oil will rise to a higher level (Fig. 3).

The tubes in the wool wick are so small that the oil will rise to a height of four or five inches in them. The oil must be free from sludge and dirt, for these readily plug the capillary tubes in the wick. Since wool is an organic material, the wicks deteriorate with age. The conditions under which the wicks operate will determine how often they must be renewed. Some oils used in axle caps have a high acidity which shortens the life of the wicks. Caustic solution is used in cleaning the bearing caps. If any of this is left in the caps it will attack the wool. Dirty oil will decrease the life of the wicks. All these things exist to some degree in normal operation and, therefore, the wicks must be renewed from time to time to insure good bearing operation.

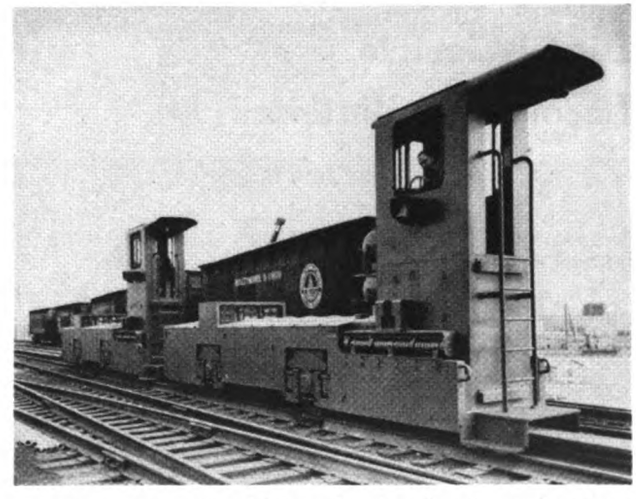
Replacing Packing.—Replacing felt wick lubricators in traction motor axle caps is easy. These wicks are properly formed in the factory so they fit into place. The springs in the caps apply the correct pressure for good operation. Wool waste packing, however, is a different story. The wool strands used for the wick must be long, continuous, and free from kinks so that the capillary tubes can do their duty. A good example of this type of waste is shown in Fig. 4. Before packing a bearing, all the wool waste should be thoroughly oil soaked.

A backing should be placed firmly behind the wick so that the wick will always be in contact with the journal (see Fig. 5). This backing also serves to squeeze the wool strands of the wick closely together to form capillary tubes small enough to get a good lift. The tighter the wool is packed, the higher the oil will lift. This can be demonstrated by placing several strands of wool loosely in a glass tube. In another tube of the same size pack many strands tightly. Figure 6 shows what will happen.

While it is true that the tighter the pack, the higher the oil rise, it is also true that the tighter the pack, the slower the oil flow. This is because the more the waste is squeezed, the smaller the capillary tubes become. A good waste packing job must be just right;—tight, firm and fully packed.

The wick should also be securely anchored at the top and bottom to prevent waste grab no matter which direction the axle is turning. This can be done by tucking the wick under the backing at the top, and the bottom, as shown in Fig. 5.

Keeping the bearing clean and properly applying the wicks are not the end of the bearing suspension job. This work must be followed up with periodic inspections on radial and lateral clearances to make sure the bearings are within their proper operating limits.



Two General Electric 40-ton electric side-arm pusher locomotives which were placed in service on the Baltimore & Ohio's new Curtis Bay Import Ore Dock at Baltimore, Md., Harbor, when it opened May 15. These units operate on a special narrow-gage track between standard railroad tracks. Power is supplied to each unit's two electric motors by a 250-volt third rail. Pincer-shaped arms, which spring out on both sides of the locomotive and hook onto the freight cars, enable the units to move two lines of freight cars simultaneously when necessary.

CONSULTING DEPARTMENT

Employee Morale

Proper maintenance of diesels requires facilities, material and skilled men interested in the work. How can morale be made an active factor in the diesel shop?

Catch Them Young

Away back in 1929, the Buenos Aires Great Southern in Argentina received its first diesel-electric units and in order to build up a competent maintenance force, the then chief mechanical engineer made a selection from amongst the younger and keener foremen to take care of the supervisory side. He chose as mechanics, electricians, etc., a number of the more outstanding trade apprentices in the locomotive works who were nearing the end of the apprenticeship.

The result was a complete success and, as far as possible, as time went on, other promising apprentices were drafted to the diesel section, care being taken to see that they were given the opportunity to see and to take part in all aspects of the work.

Thus was created a sense of moral superiority which was still evident and paying dividends during the writer's term of office as chief mechanical engineer from 1948 to 1951, by which time the increased influence of labor rules and regulations had done much to destroy the morale in other sections.

The secret seems to be "catch them young, show them everything, and promote by merit".

D. S. PURDOM
Industrial E. Comercial S.A. Sul Americana Tecnica

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—In giving an emergency charge, how long should it be continued, and how high should the temperature be allowed to rise?

A.—An emergency charge is nothing more than an equalizing charge and this should be continued until the specific gravity ceases to rise after three one-hour readings. During this emergency charge, the temperature should be kept below 115 deg. F.

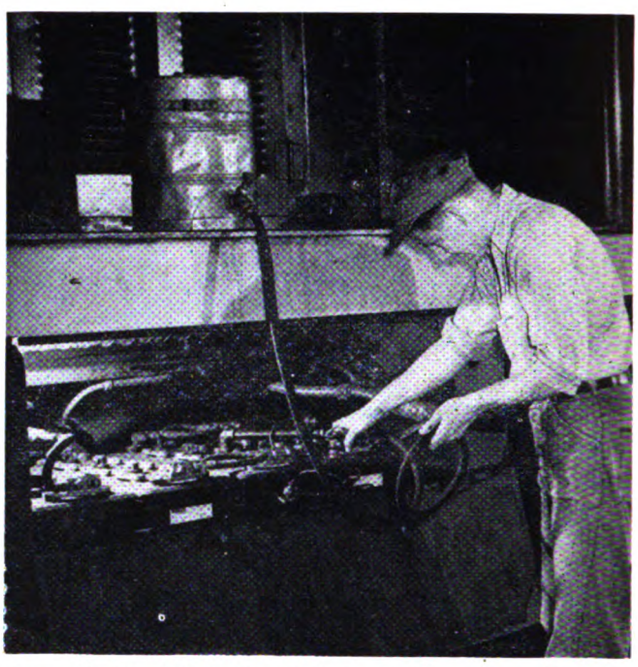
Filling

Q.—If the acid level is low, will the battery be hotter?

A.—Not necessarily. A low level may be lack of proper maintenance or leaking container.

Q.—If acid level is low, will it affect gravity readings?

A.—Yes. If the electrolyte level is at splash cover, the gravity readings are increased from 15 to 45 points, depending on the type of battery involved. (A low type battery approximately 15 points and a high type battery approximately 45 points.)



Proper flushing is important to battery performance and battery life. It also serves to check battery condition and charging rate

Q.—If acid level is only ¼ to ⅜ in. below high level, is it necessary to add water on daily inspections?

A.—The battery with proper voltage regulator setting should not require more than ⅛ to ⅜ in. of water per month. If water loss of ¼ to ⅜ in. is indicated daily, there is every indication that the voltage regulator is set too high.

Q.—What difference does it make if the water level is higher than standard?

A.—Too high a water level can only result in acid spilling out of the vent caps, causing corrosion to the terminals and connectors of the battery. This naturally results in the dilution of the electrolyte, thereby, decreasing the capacity of the battery.

Q.—How much water should a battery use?

A.—Depending on the type of battery, water consumption should be between ⅛ and ⅜ in. from the top per month.

Q.—Is regular faucet water o.k.?

A.—Regular faucet water is sometimes o.k. However, to be sure send a sample of the available water to any battery manufacturer who will analyze it for you.

Q.—Is water which has been filtered for steam locomotives good for batteries?

A.—Possibly not. It is suggested that this also be tested before use.

Q.—If battery isn't leaking, where did the acid go?

A.—During normal operation of the battery, the water in the electrolyte is broken up into gas particles and is released as such. There is never any loss of acid unless the battery is overflushed.

Q.—Is it o.k. to add acid to low gravity cells?

A.—No. Not unless it is definitely known that the low gravity is due to overflushing or a leaking cell.

Q.—What happens to a cell if it leaks and is run dry?

A.—The plates become sulphated and hard and it is entirely probable that the cell may become shorted internally and ruined completely.

Q.—How long should the electrolyte level be allowed to drop before adding water?

A.—Water level should be checked at least once a month.

Q.—What is the normal evaporation of water?

A.—1/8 to 3/8 in. per month, depending on the size of the battery.

Q.—Does this amount vary between winter and summer?

A.—It is expected that water consumption will be lower in winter than in summer. However, the operation and location of the locomotive will have a definite bearing on this.

Q.—What effect on specific gravity has overflushing?

A.—Overflushing causes loss of electrolyte, reducing capacity of battery, corrosion of battery terminals, corrosion of the battery compartment and lower specific gravity.

Q.—If acid is spilled during shipment, would you recommend adding acid or water?

A.—Acid of the same specific gravity as the balance of the cells should be added to the low cells.

Q.—When acid is lost from overflushing or from sealing leaks, what would you recommend as the proper procedure?

A.—Equalizing charge and acid adjustment.

Q.—How full should we fill the cells?

A.—This depends entirely on the size battery. For high type batteries, like the KMH, the high level is 1/8 in. below bottom of filling tube.

K. A. VAUGHAN
Gould Storage Battery Corporation

Australian Electrification Will Use Pumpless Rectifiers

By Charles Lynch

The Gippsland railway line in the Australian State of Victoria which is to be electrified in 1953, will use 1,500-volt, d.c. power supplied by pumpless, steel tank, mercury-arc rectifiers.

The line is to be electrified from Melbourne to Traralgon, a distance of 97 miles, but it is expected that trains will run from Melbourne to Warragul, a distance of 65 miles, several months before the completion of the whole section.

Electrical energy will be supplied by the State Electricity Commission. There will be 16 traction sub-stations, (6 double-unit and 10 single-unit) where 22-kv., 3-phase, 50-cycle power will be converted to direct current at 1,500 volts. This will be fed to the overhead contact wire system via high-speed circuit breakers.

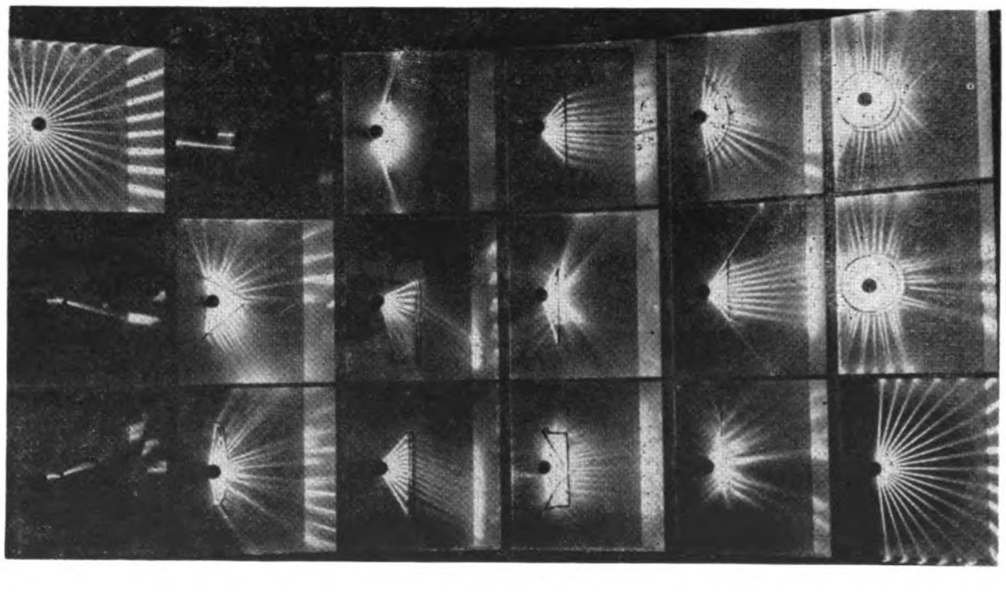
The 1,500-volt overhead contact wire system will be sectionalized at sub-stations, and in some cases at intermediate points between sub-stations where tie-stations will be installed. It is planned to have 12 tie-stations, in which high-speed circuit breakers of the same type as used in the sub-stations will be provided. These circuit breakers operate at sufficiently high speed to clear the overhead circuit they feed, in the event of fault, before any appreciable damage can be done.

All the sub-stations and the stations will be unattended, and the equipment in them will be automatic. The equipment will be under the control and supervision of a power operations engineer located in a central depot which is to be erected at Warragul. Each sub-station and tie-station will be connected to the power operations room by means of two telephone wires through which supervisory equipment will be operated.

In the power operations room, there will be a control desk and control diagram. Small red and green lamps in the diagram will indicate the condition of all rectifiers and circuit breakers to be controlled or supervised. Keys on the control desk will enable the power operations engineer to open or close any of the circuit breakers or rectifiers on the system.

Initially, the power operations engineer will have control of 22 rectifiers, 71 high-speed circuit breakers and 22 high tension feeder oil-circuit breakers.

Telephone facilities will also be provided between the power operations room and all sub-stations and tie-stations.



A Light and Vision Institute was formally opened by Holophane Company, Inc., at its headquarters, 342 Madison Avenue, New York 17, on June 28. It is designed to aid both users and manufacturers of lighting equipment. Included in a large exhibit room is the light control board shown in the illustration, and many other means of demonstrating prismatic control of lighting. Lighted pictures of actual installations border the walls, and beneath these pictures are samples of the lenses and prisms used to produce the effects shown.

EDITORIALS

Mechanical Division Meeting

The A.A.R. Mechanical Division listened to four principal addresses and 18 reports of standing committees during its twenty-fifth annual meeting, held at Chicago June 26 to 28, on subjects ranging all the way from locomotive crank pins to hand brakes, couplers, hot box alarm devices and railway sanitation. A specific effort was made this year to avoid the monotonous and sleep-conducive reading of long committee reports which have already been in the hands of members for several weeks and if briefed drastically in presentation would make that much more time available for pertinent discussion. A definite improvement in this respect was noted but much more needs to be done for a few heads still nod during long reports and, in one instance, an important prepared discussion could not be presented for lack of time.

The Mechanical Division, through its experienced officers and secretary's office, initiated a movement early in 1951 to improve the quality of committee reports and particularly the conduct of annual meetings so as to assure maximum benefits to individual members and the railroads they represent. A circular letter was sent out last January calling for (1) early distribution of committee reports to allow ample time for study in advance of annual meetings, (2) clear and concise presentation of committee reports, (3) instructive discussion of reports, and (4) more people participating in discussions.

Definite progress has been made in advance distribution of the reports, all being available this year from one to four weeks before the annual meeting. To achieve this end, the secretary's office spared no effort in getting reports out to members as soon as received from the printer even though this involved several extra mailings. In view of extra time now required for the purely mechanical job of getting reports through the print shop, it seems obvious that committees have a definite responsibility to start their work earlier in the year and progress it faster if the reports are to be made available sufficiently in advance of the annual meeting.

The situation as to presentation of reports has already been covered with the statement that some reports were briefed this year and more should have been. Discussions this year were for the most part pertinent and instructive, but far less general and argumentative than could be desired. Admitting that most differences of opinion are ironed out in committee meetings before presentation of the reports, there must be some questions of fact or policy which can be discussed with profit in an open meeting of all the members.

There is much which can and probably should be said with respect to wider participation in the active discussion of the reports. This is desired and yet, with chief mechanical officers of individual railroads in such general attendance, is it logical to expect their subordinates, even key staff men, to be very vocal? Especially in the case of subjects which may be controversial, they are more likely to think: "If the boss wants something said about this, let him say it." In reality, if the boss is a real leader, he doesn't want to discourage constructive comment or criticism and probably he admires a man with spunk to say what he thinks.

In view of the need for more pointed and wide-spread discussion if future annual meetings of the Mechanical Division are to achieve maximum usefulness, it would appear desirable to do more than has been in the past to assure a goodly number of prepared discussions, both written and extemporaneous, of the various reports. One way to stimulate voluntary discussions would be for chief mechanical officers to authorize more of their line officers, as well as staff men, to attend and specifically encourage them to participate at will in all discussions of subjects in which they are specialists.

Basic Factors in Reducing Hot Boxes

The factors involved in reducing hot boxes and improving overall freight-car bearing operation are known to be many and varied. Basically, the problem appears to be vulnerable to attack in three principal ways: (1) better observance of existing rules, (2) the development of a cheap but reliable detector for troubles that do occur, (3) a substantial improvement in design, including principle of lubrication and lubricant specifications.

Stricter adherence to rules pretty well speaks for itself. Its role and relative importance in solving the problem has been speculated on for many years, is being speculated on, and undoubtedly will be for many years to come because the effect is not readily measured. The importance of stricter rule observance should not be dismissed lightly, however, because there is much more reason to assume that it would be substantially beneficial than there is to think the effect would be neglible,—particularly in view of open admissions from time to time by high-ranking mechanical officers that their own roads often do not live up to all the rules.

Development of a cheap enough hot-box detector has been attacked on the grounds that it merely indicates trouble when it occurs rather than correcting the basic fault. An effective detector, while having little effect on road delays, would at least prevent the worst troubles, i.e., wrecks. And, even if a perfect bearing assembly were developed, a good detecting system would still be of inestimable value during the period while cars were being changed over.

It would appear to follow that the third alternative—

better design of part or all of the existing bearing assembly—should be pursued simultaneously with the other two. It would also appear that the only thing that is holding back the solution to the general problem is the lack of money with which to tackle the job. There is little doubt that there is sufficient ingenuity among railroad personnel, and there are sufficient facilities available in this country, to solve this problem much faster than it is being solved. Perhaps the money would be more easily forthcoming if each chief mechanical officer would ask his management just two questions—how much is it worth to eliminate hot boxes, and is anywhere near this amount of money being spent to eliminate them.

Electric Motive Power

Reasons for the overwhelming incidence of the diesel-electric locomotive were examined critically by electrical engineers at the Summer General Meeting of the American Institute of Electrical Engineers, held in Toronto, June 25-29. They gave full recognition to the capabilities of the diesel, and agreed quite generally that all railroad motive power of the future would be some type of electric locomotive or car. At the same time, they expressed some wonderment at the almost universal apathy of American railroad men toward the steam locomotive.

In effect, they looked around the world to explore the reasons why some countries use diesel power while others have electrified a large part of their lines and still others adhere to steam. G. Huldschiner, of the College of the City of New York, in presenting a paper on future aspects of electrification, said that one very clear reason for the adoption of the diesel in this country is that oil is abundant and cheap, whereas the countries practicing full electrification in Europe have large resources of cheap water power, not too much coal, and very little oil. He also said that a country with government-owned railroads, even if it is not too prosperous, will find money for its railways. Contrarywise, a private corporation, mighty and powerful as it might be, but suffering from government subsidized competition, and already heavily in debt, faces heavier interest charges and may have difficulty in securing sufficient capital for electrifying a part of its lines.

It became apparent in the discussion that each country had good reason for using the types of motive power it has in service. It is also evident that most of the factors described in the preceding paragraph mitigate against the adoption of more electrification in this country.

On the other hand the subject of electric motive power is very much alive. The diesel is, in fact, an electric locomotive which carries its own power plant. Large quantity production of the diesel has served to improve the quality and reduce the cost of locomotive electrical equipment. The diesel could, if it were desirable, be adapted to operation from an electrical contact system.

In the field of straight electrification, there have been many notable developments in motors and control equipment. The rectifier locomotive recently built represents an innovation which would permit the use of commercial frequencies on the contact system, thereby eliminating the hurdle of wayside conversion.

To aid in the making of surveys, T. M. C. Martin, of the Bonneville Power Administration, produced a method, presented in a paper, which offers a greatly simplified method of making initial surveys to determine the possible economic advantage of electrifying a certain section of a railroad.

The gas-turbine locomotive is beginning to offer some competition to the diesel. It can burn low-grade oil and may be able to use coal. Steam-turbine-electric locomotives, burning coal, have been built and more will be tried.

Should the price of oil increase considerably, relative to that of coal and electric power, railroads would again begin to explore the advantages of straight electrification or other forms of motive power. In such an event, they would approach the subject with vastly improved knowledge and with greatly superior equipment.

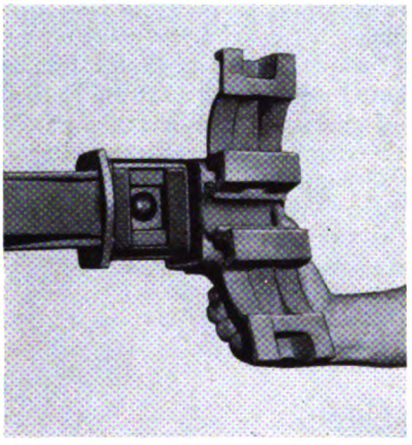
An Opportunity To Discuss Cases

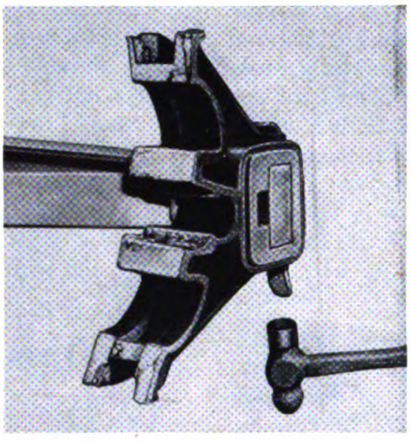
Running through the entire pattern of the Mechanical Division meeting at Chicago there was plenty of evidence that new types of equipment both in the locomotive and car field, coupled with operating practices that have been developed to increase the efficiency of railroad operation, have multiplied maintenance-of-equipment problems. Many of these problems are difficult because in the case of equipment and accessories of compartively recent design and of limited service experience, it sometimes takes years to make the refinements in design from which economical maintenance and trouble-free service result. Only the free interchange of ideas and a broad discussion of the service experience of one road after another can develop data that makes it possible to analyze troubles and apply remedies without undue delay.

Mechanical-department personnel, from officers to supervisors and specialists in the shop and on the road, are particularly fortunate in having a group of associations such as those that meet in September at Chicago which offer the opportunity to bring out the many problems that everyone has to deal with in everyday operation and maintenance work both in the locomotive and car departments. An examination of the programs of the mechanical and electrical groups which appear elsewhere in this issue will immediately impress anyone with the fact that these several associations have done a real job in planning and co-ordinating programs in such a manner as to bring out into the open as many kinds of problems as possible. Fortunately, also, these associations, because of the character of the attending membership, have shown a definite trend toward free discussion of equipment operating and maintenance difficulties as well as a trend toward a minimum use of time for presentation of reports, allowing more time for discussion.

Every mechanical man should look upon these meetings as an opportunity to get his troubles out into the open so that some other member may offer the solution if he has it. It also serves as a real guide to the manufacturer in knowing what troubles railroads have experienced, and to the Mechanical Division, a guide to recommendations for design changes.

NEW DEVICES





Brake Beam with Quick-Removable Heads

With the recent issuance of an A.A.R. Certificate of Approval to the Buffalo Brake Beam Company, New York, covering the new No. 18 freight car brake beam to be known as the Buffalo Truslock, freight car brake rigging will now have all of the operating and maintenance advantages inherent to the quick-removable brake head, standard on passenger cars and locomotive tenders.

The removable sleeve-type brake head has been a significant factor in the present-day high availability of passenger equipment. Barring accidental damage, it is not unusual for passenger car brake beams to remain under the car for considerable periods, even though the brake heads, being the most vulnerable part of the brake rigging, must be frequently changed.

It is claimed that the new Truslock brake beam — the principal feature of which is a novel design of the brake beam ends, permitting the removal of a worn or damaged brake head right at the car by the mere withdrawal of a simple spring-key —will likewise be an important step in the direction of reducing freight car delays due to removing and replacing the entire brake beam when wear or damage requires the application of a new brake head. The new brake beam is of the conventional hanger type of suspension, and is fully interchangeable with A.A.R. former Nos. 3 and 15 and the present No. 18 brake beams.

It is estimated that worn or damaged brake heads account for more than 50 per cent of all freight car brake beam removals. Thus the use of a removable type brake head for freight cars would tend to reduce the volume of brake beams now being sent to reclamation plants by a like amount. In addition, there would be, of course, a corresponding reduction in labor, transportation and handling charges incidental to the movement of brake beams between repair points and reclamation points.

Of interest to mechanical and stores department officers are such features as sleeve and brake heads that are interchangeable on either side of the brake beam, which considerably reduces the inventory on these items; the breathing action of the Truslock brake head reduces operating stresses on the beam itself while considerably lessening wear and tear on the heads; and the truss structure of the new brake beam is completely independent of the brake heads.

The manufacturer states that in addition to the A.A.R. tests upon which Truslock's approval was granted, road tests covering a period of several years were conducted in cooperation with a large Eastern railroad, where a number of the new brake beams were subjected to the severest operating conditions.

The Buffalo Truslock brake beam (A.A.R. No. 64) has been designed primarily as a maintenance brake beam for freight cars equipped with hanger type trucks, and is different from the Buffalo Unit-type brake beam (A.A.R. No. 51).

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Gripco Nut for Railroad Use



The Grip Nut Company, Chicago, is now introducing for railroad use the Gripco lock nut which incorporates all principal features including holding power of the No. 3 hot-pressed unit nut heretofore widely distributed and used in railway service. The Gripco nut is the same single unit now available as a semi-finished, thoroughly pretested lock nut in which the holding power is secured by six triangular indentations in the top surface made in the final cold pressing operation.

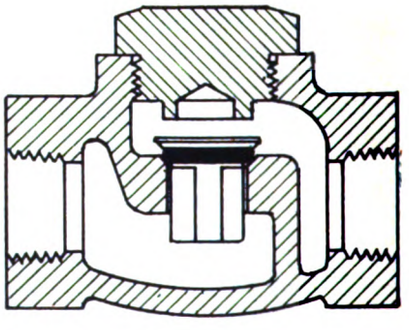
Because of its semi-finished features, the Gripco nut is being offered as a replacement for the No. 3 nut. It is available in hexagon form only with sizes ranging from ¼ in. to 1⅜ in. in either American Standard heavy or regular dimensions. A folder giving complete specifications for ordering the nut has just been prepared.

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Two Diesel Locomotive Valves

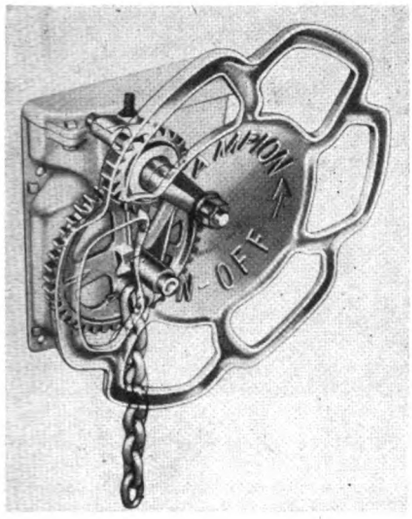
For operating air horns where conditions require the selection of a modulated blast or full blast the Viloco Railway Equipment Company, Chicago has introduced Type 1090 Air Horn Operating Valve which will permit this control by a single lever. At the initial movement of the lever, the center seat is raised, permitting air pressure to pass through a small outlet opening to the air horn, producing a modulated blast. For full blast, added force on the lever raises a large seat, opening the valve to full area.

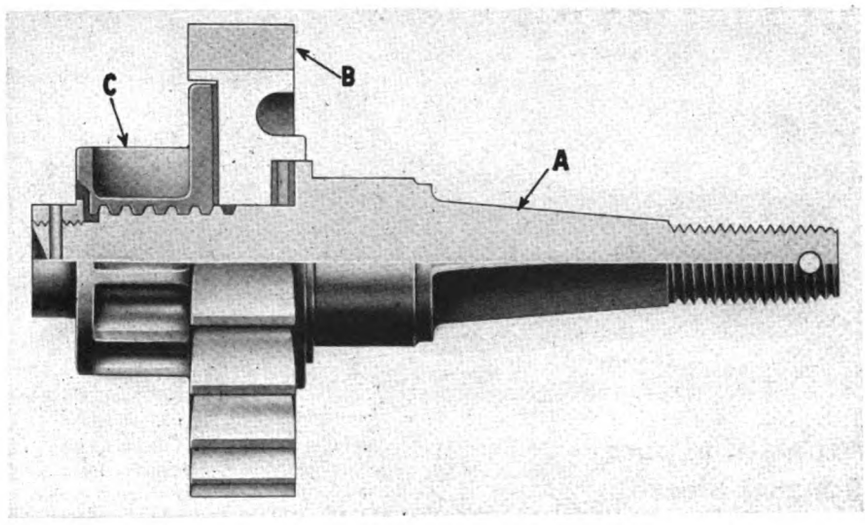
This valve will operate any type of air horn, single or multiple tone, and provides selective control with only one operating



lever. The valve cage can be removed without disturbing the valve body. The Viloco single valve No. 1056 can be converted to modulated control by replacing the internal parts of the 1056 with those of Type 1090.

The second new Viloco device is a check valve for air systems in the ¼, ⅜ and ½ in. sizes, which is claimed to be absolutely bubble tight and to retain air pressure indefinitely in the service of retaining pressure to permit reversing of diesel engines. The "0" ring seat is capable of withstanding a hydraulic pressure test of 2,000 p.s.i., and the valve has been subjected to 140,000 operations under air pressure test without injury to the synthetic rubber ring seat.





Freight Car Hand Brake

The National Brake Company, New York, is offering to the railroads the Champion-Peacock brake which was introduced in its original form in 1937 as the Champion Micro-Matic hand brake. One of the unusual features of this brake is that it may be relased in any degree simply by manipulating the hand wheel.

This brake is operated by simply turning the wheel clockwise to set the brake and counter-clockwise to release it. Any degree of application or release can be made independently of the other and from any point throughout its travel capacity. Basically this method of operation is accomplished by the use of an industrial-hoist type clutch. The clutch consists basically of three parts—a hand wheel, shaft, a ratchet and a pinion, augmented by clutch facings and back-off stops. The latter two are refinements of the basic principle involved.

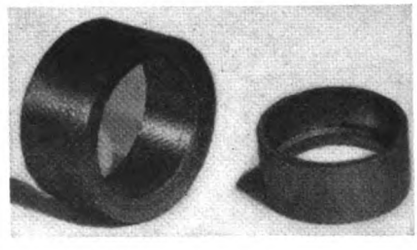
Referring to the cutaway view: Assuming the brake is to be set or applied, the hand wheel shaft *A* might be considered an ordinary bolt whose head corresponds to the threads on the right end, fitted with a washer *B*, i.e. the ratchet, and a nut *C*, i.e. the pinion. Bolts can, of course, be tightened up by either turning the nut onto the bolt or turning the bolt into the nut. Assuming that the nut *C* is held and tightened up by turning the bolt *A*, thereby squeezing washer *B*, the pressure set up by this squeezing action prevents the brake from turning backward since the washer *B*, actually the ratchet, is held at all times from turning backwards by a pawl (in phantom view).

To release the brake the bolt *A* is turned counter-clockwise which, of course, tends to unloosen the nut *C* thereby releasing the pressure on *B*, permitting it to stand still while the bolt and nut *A* and *C* can be turned counter-clockwise in unison.

Assuming again that the brake has been set or applied, the force created by the brake in the brake rigging is naturally transmitted back to the nut *C*, i.e. in the pinion, in a direction of tightening it on to its bolt *A*, i.e. hand wheel shaft, thereby maintaining the pressure on *B* located between *A* and *C*. The brake will remain in this position indefinitely without loss of power. It will not rattle or jar off, but it can be readily released by simply turning the hand wheel counter-clockwise.

The brake is said to have proved successful from an operating and maintenance standpoint for the following reasons: A switchman can control a freight car equipped with this brake with about the same ease as an automobile can be controlled with foot brake; all operation of this brake requires only the operator's right hand, the left hand being used at all times for holding on to the car; the brake is fully released simply by pulling the wheel counter-clockwise until the load has been released from the chain; even abnormal pressures, such as found when the hand brake has been set up on top of emergency air and the air bled off, can be released by one hand; and it is equipped throughout with self-lubricating Oilite type bushings, each backed up by its own individual lubricant reservoir.

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Conduit Joint Gasket

A gasket for vapor steam conduit joints on steam hose has been introduced for railroad service applications by Pilot Packing Company, Sea Cliff, N. Y.

This gasket is manufactured from asbestos fabrics combined with high heat resistant compounds molded with close tolerances to conform with contour of the nose piece and gasket cavity of the joint.

The manufacturer states that under high-pressure steam heat and steam jet air conditioning, tests indicate longer life because the gasket will not vulcanize into the cavity, thus maintaining joint in better condition and reducing overhauling costs. Steam generation costs are thereby reduced by less steam loss through leakage.

Identified as style No. 1315, these gaskets are available in 2 and 2½ in. sizes.

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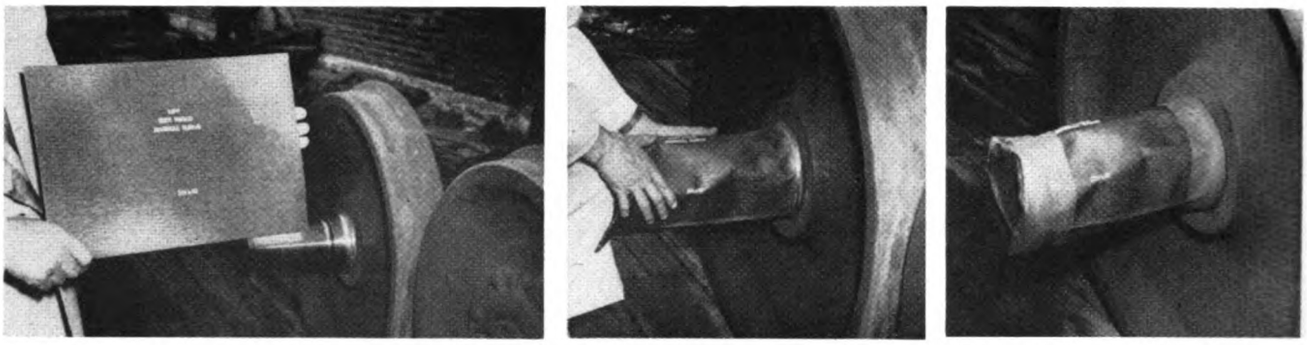


Silastic Tape Insulation

According to its manfacturer, easy-to-apply Silastic Tape, Type R, vulcanizes to form a continuous void-free jacket that is moisture proof, stable and resilient at top Class H operating temperatures (180 deg. C.), as well as highly resistant to oil and to both mechanical and electrical fatigue. Over 4,200 main and interpole field coils insulated with Silastic Tape, Type R, are in service on diesel-electric traction motors.

Many of these coils have been in service for more than 15 months with no failures reported even in the case of one locomotive that was suddenly thrown into reverse by a short circuited control panel. The cost is comparable to Class B coils; life expectancy is in the range of 10 to 1.

Silastic tape is manufactured by Dow Corning Corporation, Midland, Mich.



Lipp rust-proof journal sleeve before application. Center: The sleeve is pressed firmly over the journal and dust-guard seat. Right: Taping the sleeve holds it securely in place. A slight tug will remove the sleeve.

Lipp Rust-Proof Journal Sleeve

A rust-proof journal sleeve, recently developed by the J. J. Lipp Paper Company, Chicago, consists of a heavy, creped, waterproof and reinforced material, laminated on one side with VPI (vapor phase inhibitor) and fabricated in sleeves to fit over and protect machined axle journals. The action of the VPI chemical rust inhibitor is described as formation of a vapor, the molecules of which adhere to metal surfaces within the container, chemically attack oxygen and hydrogen in the confined space and make these gases inert as far as corrosion is concerned.

VPI is patented by the Shell Development Company, and paper impregnated with this material is made under licence by the Angier Corporation for general industrial packaging. Thorough tests indicate that this new rust preventative may revolutionize ordinance packaging and it is already being widely and successfully used on high-finished diesel engine parts during shipment to railroads where these parts are said to arrive in excellent condition and ready for immediate use without cleaning.

The Lip rust-proof journal shield also has shown favorable results in tests by the Griffin Wheel Company, a leading car builder and about 20 railroads to date. The sleeve is received as a heavy flat envelope with the VPI impregnated paper on the inside.

In applying the sleeve, the closed end is pushed in forming the sleeve into a round tube. It is then placed over the journal and dust guard seat and held there with the knee while a strip of Lipp's waterproof pressure-sensitive tape is applied, half on the axle shoulder and half on the sleeve, and wrapped completely around the axle. This holds the sleeve on the axle and keeps water out. The ends are then folded back and taped down to form a neat tubular cover. In removing, a slight tug on the tape is all that is required to release the sleeve.

In practice, newly-turned journals will be protected at the lathe, and moved into storage with the sleeves attached. When the wheel assembly is ready for installation in a truck, it is rolled to the truck and the sleeves removed, requiring only a few seconds. These sleeves are then placed on the bad-order journals to furnish protection until the wheel and axle assemblies are returned to the wheel shop.

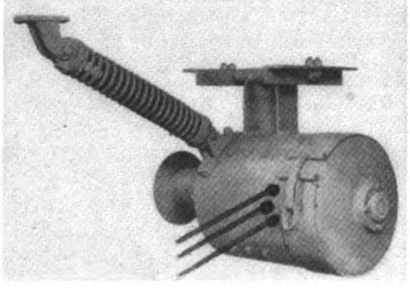
It is expected on the basis of test observations of VPI material that the Lipp shield will protect journals in out-door storage up to two years. In addition to other advantages, use of the sleeve will avoid the necessity of periodic repainting the journals of stored axles and wheel assemblies. The sleeve is presently being made in three sizes, 5 in. by 9 in. 5½ in. by 10 in. and 6 in. by 11 in. If desired it can be supplied in extra lengths to extend over and protect finished wheel seats as well as the journals.

Caboose Power Supply

A lightweight and easily maintained generator which is said to meet requirements for radio power supply equipment for caboose installations has been developed. For use with a nominal 12-volt storage battery, the unit, made by the Safety Car Heating & Lighting Co., New Haven, Conn., is rated 1,000 watts, 15 volts; and for a nominal 6-volt battery, the rating is 850 watts, 7½ volts. It has a full load speed of 500 r.p.m., and a cut-in speed of approximately 375 r.p.m.

Suspension is of the universal type and arranged so that the armature pulley can be placed on the center line of the car. It can be applied to existing cars with only minor changes in the underframe. Alinement of generator with car axle is said to be easily accomplished and suspension provides constant belt tension.

The generator regulator is a modification of standard models and method of adjustment and type of control are indentical with those of the standard car lighting generator regulator. It is mounted on a steel panel. The reverse current relay is mounted on the regulator panel.



The regulator can be supplied with a standard black enamel cover, by the use of which the car electrical locker can, it is stated, be dispensed with, saving considerable installation cost.

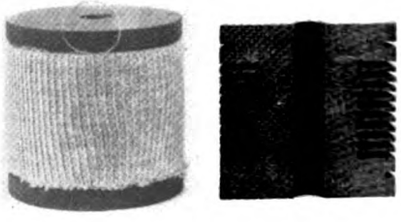
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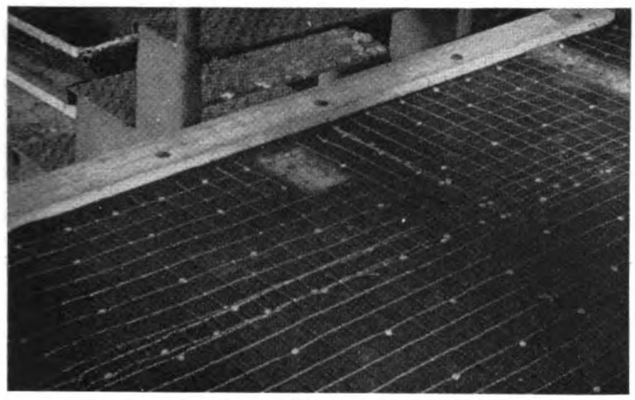
Cellulose Oil Filter

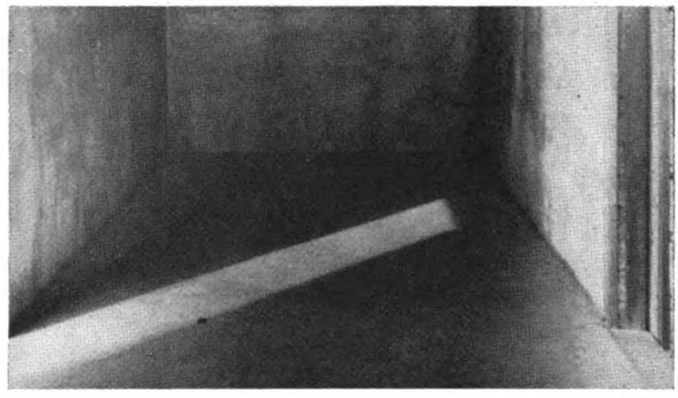
An oil filter, using molded cellulose fibers as the cleansing medium, has been developed by the Briggs Filtration Company, Washington, D.C. Complete filters and replacement cartridges are available for standard makes of automobile, truck and heavy stationary and mobile equipment.

A bonding agent is applied to natural cellulose materials which are formed, under pressure, into cartridges of blocks. The size of fibers controls the porosity of the block. These blocks are then stabilized by a series of thermal processes which fix the finished dimensions. Cartridge blocks are rendered impervious to water and therefore retain their original dimensions in use.

Reports from users indicate, according to the manufacturer, that this medium has an exceptionally high dirt retention capacity, and that there is no "unloading" action between filtration cycles. The overall efficiency and long life of the filter are therefore described as exceptional.







Flooring for Box Cars

A recently developed nailable flooring, made of oxychloride cement and called Plastinail, is now being used as a method of renovating worn box car floors. A feature of the flooring is that blocking nails may be applied in any location and readily withdrawn with little or no chipping of the material. The following advantages are claimed for this new flooring material: It does not require any change in floor design; is easily applied and can be placed in service 48 hours after setting; is flexible and light in weight; will not splinter; increases floor compressive and transverse strength in some instances over 100 per cent; is permanently smooth, minimizing damage to lading; prevents leakage of bulk materials; is fire and spark proof; is resistant to oils and greases and easy to clean; is not affected by heat or cold; and promotes long floor life with minimum out-of-service time.

The installation of Plastinail flooring is accomplished by first covering the old floor of the box car with 15-lb. asphalt-saturated felt paper. This provides a separation for independent expansion between the old wood and the new Plastinail floor. No. 16 gage, 2-in. sq. mesh reinforcing wire mesh is then nailed over the paper. Retaining strips are fastened in the doorways of the car. A wet mix of Plastinail is prepared and troweled into the wire mesh to a thickness of 1 in. and then smoothed level. Additional trowelings are given the floor to obtain the desired smoothness. Plastinail may also be applied in the same manner, ⅜ in. thick, to the insides and ends of box cars to reinforce the interiors and give a smooth surface for handling bulk shipments without danger of damage or possible infestation.

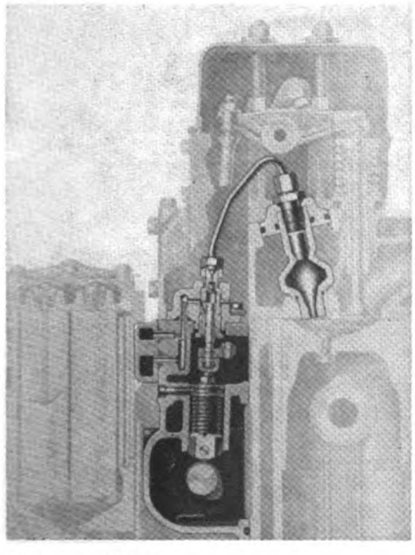
The first Plastinail floors were applied in June 1947, and test cars are reported to be giving good service on 27 railroads, including one which has 62 box cars equipped. Experience indicates that the only damage normally encountered with these floors consists of nail holes and other small holes which may be easily repaired by applying a mixture of the original material with a trowel at minor cost.

Plastinail is a joint development of the F. E. Schundler Company, Joliet, Ill.; the Westvaco Chemical Division, Food and Machinery Chemical Corporation, Newark, Cal.; the Dow Chemical Company, Midland, Mich.; and the Weyerhaeuser Timber Company, Minneapolis, Minn. Plastinail is distributed by Schundler east of the Rockies and by Westvaco on the West Coast.

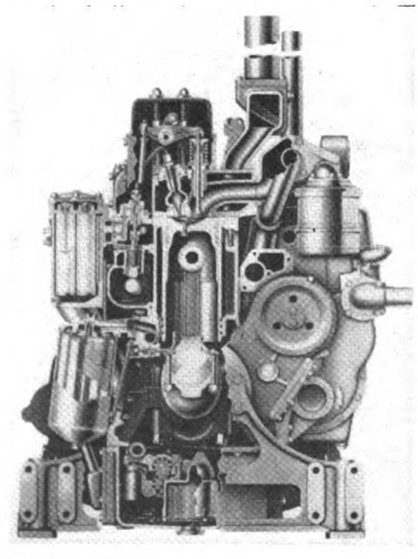
Diesel Engines with New Piston Cooling System

Two new Caterpillar industrial diesel engines, the D337 and D326, are scheduled for production soon, by the Caterpillar Tractor Co., Peoria, Ill. The six-cylinder D337 engine is an industrial version of the 5⅛ in. by 6 in. engine developed for tractors, while the D326, similar in design, has a lower horsepower range.

One feature of the two models is the practice of mounting fuel pumps adjacent to the cylinders they serve. This results in standard, identical, short fuel lines for each cylinder.



Cutaway view



Cross section

Oil-cooled pistons on both models have an iron band cast integrally for the upper ring, and are cooled by an oil stream sprayed from a nozzle solidly attached to the engine block. Since this spray lubricates the piston pin, as well as cooling the piston, oil grooves are not required in the connecting rod.

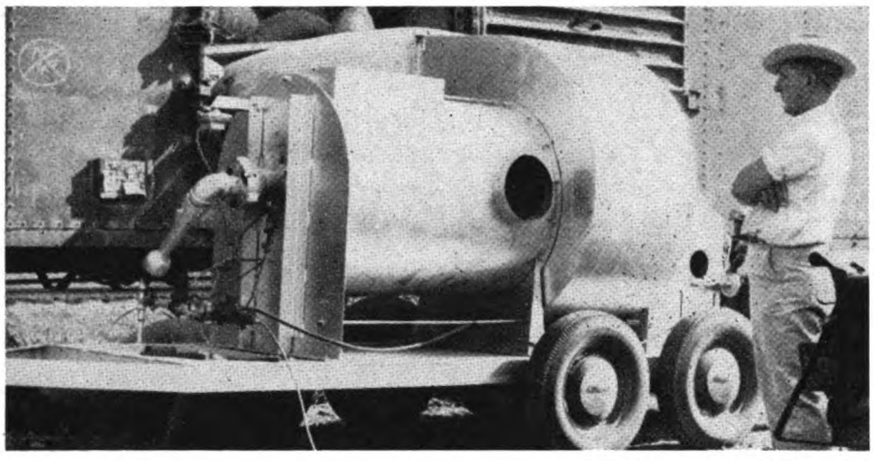
Fine filtration elements which handle the full flow of oil to the engine system are incorporated in both engines. Oil passageways are protected from dirt and foreign material falling into them while filter elements are being changed, and sludge collects where it cannot enter the oil passageways or relief valves.

Horsepower ratings for the new engines (without fans) are for the D337 and the D326, respectively, 275 and 186 peak; 250 and 171 intermittent; 180 and 125 rated; and 170 and 118 hp. continuous.

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Portable Dryer and Heater

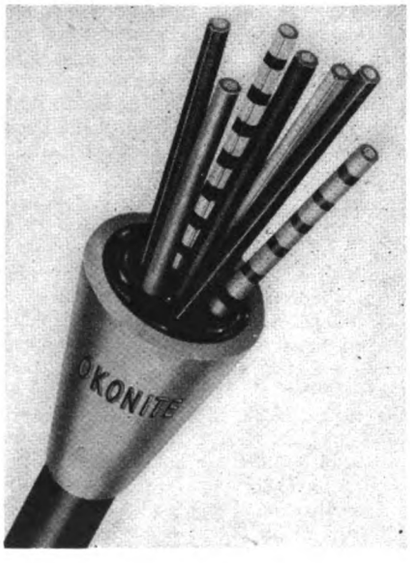
For such diverse applications as thawing, preheating, and drying of agricultural, industrial and other products carried in rail-



road cars, the Southwest Industrial Heating Engineers, Dallas, Tex., has introduced the Farm-Mor Portable Dryer and Heater. Other uses of the unit include supplying a source of heat for emergency crews working in subfreezing weather and under other difficult conditions.

These units are manufactured in three sizes, either trailer- or skid-mounted, and come with complete temperature controls and 100 per cent safety devices to shut off all fuel in event of mechanical or flame failure.

Standard models deliver heated air at temperatures up to 200 deg. F. and in capacities up to 23,000 cu. ft. per min. available.



Waterproof End Seal

A moisture seal for terminating multiconductor sheathed cables is offered by the Okonite Company, Passaic, N. J. Cone-shaped to receive filling compound, this device is easily slipped over the cable and eliminates friction tape or makeshift windings.

Applicable to cable diameters from ¾ to 2 in., the Okonite End Seal snugly fits over the cable sheath, preventing compound leakage. The compound hardens to form a neat, permanent, moisture-proof seal and keeps conductors properly spaced.

This seal is said to be mechanically strong and to afford long-time resistance to sunlight, air, ozone, oils and chemicals.

Battery-Less Car Lighting System

A method of operating car lighting systems offered by the Waukesha Motor Company, Waukesha, Wis., eliminates the conventional 400-1,000 ampere-hour car lighting battery. The method employs only an ordinary automotive-type battery—five 6-volt units in series on a 32-volt system, or five 12-volt units on a 64-volt system—to start the Enginator (Waukesha trade name for an engine-generator system) and activate the controls.

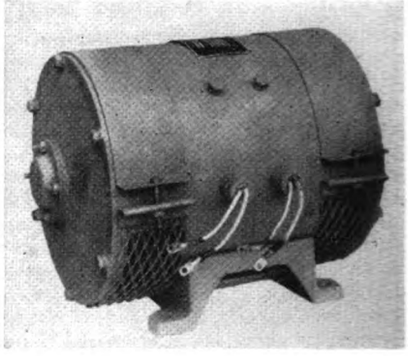
The battery-less d.c. Enginator was inspired by the reliable and satisfactory operation of a.c. Enginators, which, because no car lighting battery can float on the a.c. lines, must supply the complete electric requirements for each car by operating continuously.

Attracted by the possibility of saving several thousand dollars per car in capital investment and annual maintenance charges by substituting the small automotive type battery for the large car lighting battery and, in addition, saving the under-car space and dead weight of the larger battery, one major railroad has given the Waukesha B-L (battery-less) system a six-month winter's trial this past year, on a daily run between Chicago and Denver. As a result of this experience 20 more cars of this road will be changed over to the Waukesha B-L system this year.

The equipment employs the Standard Waukesha 7½-kw. d.c. propane Enginator either 32-volt or 64-volt, or the 25-kw. d.c. diesel Enginator, also 32- or 64-volt, a simple automatic battery charging panel to maintain the small starting and control circuit batteries, and another control panel for continuous Enginator operation.

The Waukesha B-L system with controls is being offered for either new car installation or for converting existing installations.

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700 Watt Dynamotor

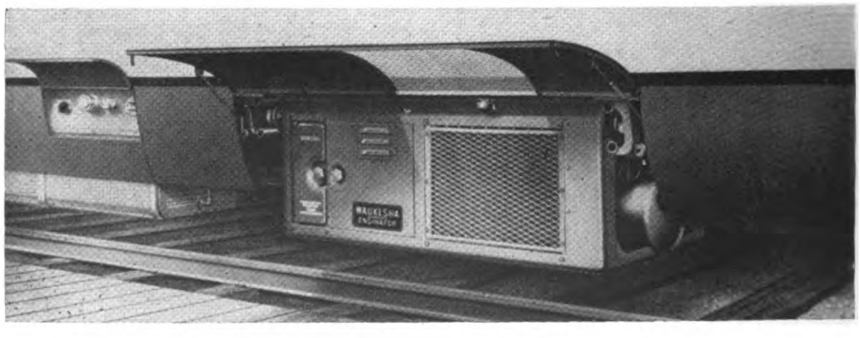
Electrical isolation of the braking circuit from the main power line is provided through a new 700-watt dynamotor recently introduced by the Safety Car Heating & Lighting Co., New Haven, Conn. With this device, the braking circuit is independent of any grounds which may occur on the primary source.

Output voltage of the device is increased approximately 2 volts above any input value. At the lower values of voltage encountered on diesel power operation, the slightly higher voltage in the braking circuit is said to insure better and safer magnet valve operation.

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Three Diesel Products

Three products recently brought out for application to diesel locomotives by the Wilson Engineering Corporation, Chicago

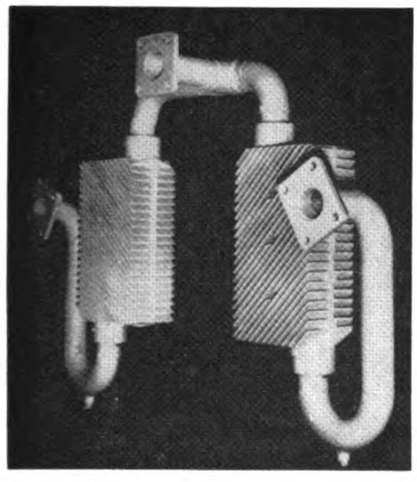


3, include a final radiation cooling system, intercooling assemblies for Gardner-Denver and Westinghouse air compressors, and a fuel oil heater which uses by-passed engine coolant without any waste of heat.

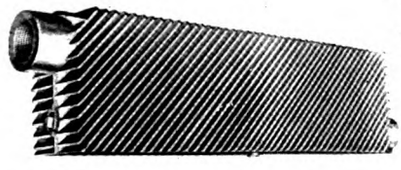
The final radiation cooling system is made of aluminum, has a weight of 65 lb., and occupies a space 34½ in. by 5 in. by 8⅜ in. The heat transfer of a single element in static atmospheric air is equivalent to 30 ft. of 1½-in. standard pipe. Two elements mounted in parallel are equivalent to 80 ft. of the 1½-in. pipe.

The intercooling assembly is adaptable to both Gardner-Denver WXE and WXO air compressors, and to Westinghouse types 3-CD and 3-CDB. The assembly has a radiation equivalent of 40 ft. of 1½-in. pipe, weighs 120 lb., and is factory tested to 300 p.s.i.

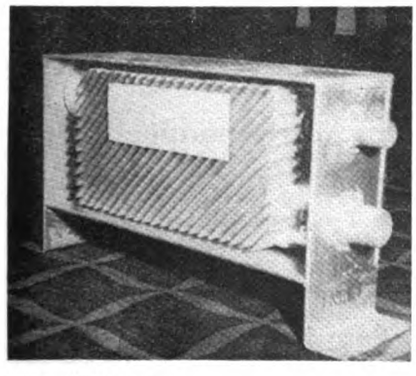
The fuel oil heater occupies a space 24 in. by 12¾ in. by 6⅜ in. It maintains the desired fuel oil temperature by a regulating valve which controls the flow of the by-passed jacket water.



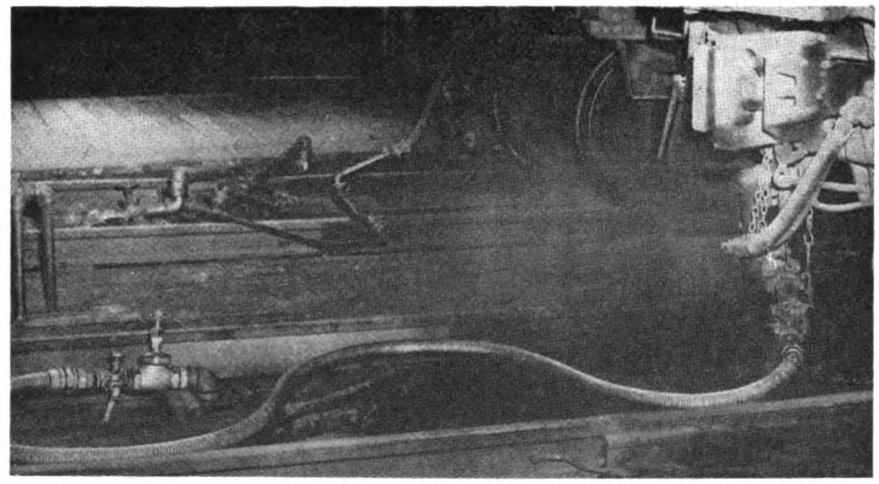
Intercooling assembly



Aluminum radiation element



Fuel oil heater



Flexible Metal Tubing

A handy hookup for car heating applications has been introduced by the American Brass Company, American Metal Hose Branch, Waterbury, Conn., employing flexible metal tubing complete with fittings.

The product is described as easy to connect and disconnect as it replaces heavy, cumbersome, leaky swing joints which require packing and frequent maintenance. The tubing can be used to convey steam from 125 to 150 lb. per sq. in. pressure from heating connections to railroad cars lying over for temporary stay, loading or changing locomotives.

Ease of connection and non-corrosive properties of the casing afford protection against abrasion, adding to strength and long life. The whole assembly is said to be constructed to withstand inclement weather, light-weight, extremely flexible, and leakproof throughout to provide against loss of steam.

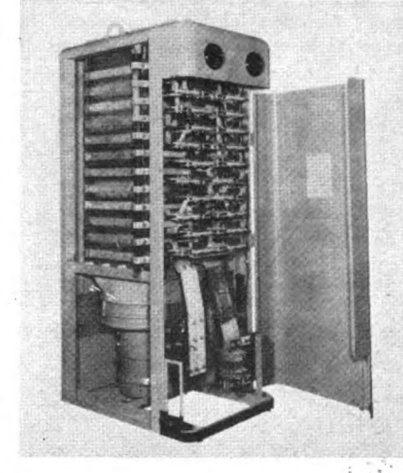
Loading Resistors for Diesel-Electric Locomotive

A new portable loading resistor (Type 17EM55D2) for load testing diesel-electric locomotives up to 2,500 hp., has been announced by the General Electric Company's Locomotive and Car Equipment Divisions, at Erie, Pa. The resistor is rated at 3,450 amp. continuous, and 4,000 amp. for 15 minutes.

The unit was designed for run-in tests, running-in new bearings and similar parts, setting generator current limit, and setting diesel horsepower obtained over the constant horsepower portion of the generator characteristics. The new resistor is a completely self-contained unit, requiring no external mechanical, liquid, or electrical connections except the power cables connecting the locomotive and the resistor. Resistor loading is constant, not varying from cold to hot. Mounted, the loading resistor is easily moved by a battery truck, and can be used indoors or outdoors.

The resistor assembly consists of 12-air-cooled resistors. Elements are aluminum-chromium-iron resistance alloy in parallel strips providing maximum surface area for cooling. Designed to operate at maximum temperature of 350 deg. C., the elements are supported in frame slots to permit expansion of elements under load. The resistor frame is made of asbestos-lumber insulation with strip-steel supports to withstand high temperatures.

A blower unit is mounted vertically, commutator end down, under the loading



resistors. An air diffuser, between fan and resistors distributes air from screened intakes at the base over the resistor assembly to dissipate heat generated by the electrical load. Blower speed automatically increases with resistor load. So the resistor will not operate without the blower, power from the resistor operates the blower.

Testing points are obtained by a combination of switches on a panel inside the resistor door. Knife switches are easily set to the testing point desired, and the door is closed to provide a dead front.

Two high-accuracy, long-scale, switchboard-type instruments are permanently mounted on the case above the access door. Output is indicated in volt and ampere ratings, and is easily converted to horse-

power. If desired, portable instruments can be attached to the unit to permit readings in the locomotive engine room.

To operate the loading resistor, the operator selects a desired resistance step by closing the proper switches on the switch panel. The power plant is then started and brought up to speed, and readings are made from the instruments to determine output. Before changing to a different resistance step, the power plant is idled so switching is not done under load. All generator fields or main shunts should be included in the load test circuit to properly control the characteristic.

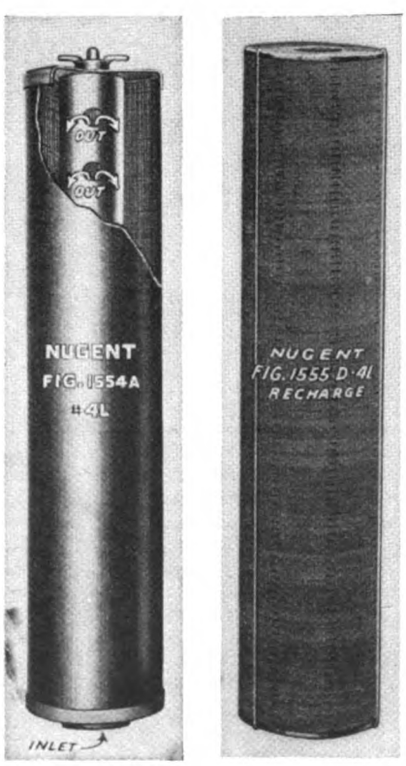
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Lubricating Oil Strainers and Filters

Wm. W. Nugent & Co., Chicago, has recently brought out two new products for the lubrication system of locomotive diesel engines. The first is a full-flow lubricating oil strainer, which has a capacity for the entire output of the engine lubricating oil pump; all oil pumped to the engine must pass through this strainer. Because of the dirt in the oil being retained in the strainer basket, the strainer is easily cleaned, normally when the oil filters are cleaned.

The second product, a cellulose disc type filter recharge, was developed because of the scarcity and high price of long strand white cotton waste for lubricating oil and fuel oil filtering. These recharges will fit Nugent fuel and lubricant filters now in service on diesel locomotives. The present cotton waste type filter is converted to the cellulose disc type by removing the present cartridge containing the cotton waste recharge from the filter shell and replacing it with the new cartridge.

Because of the large amount of filtering area of the cellulose disc recharge, the service life is reported to be four to five times that of the cotton waste recharge.



Left—Strainer basket of full flow lube oil strainer. Right—Cellulose disc type filter recharge

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Hinged Vent Cap

A self-closing vent cap designed for car lighting and air conditioning batteries has been made available by Gould-National Batteries, Inc., Trenton, N. J. This hinged device is said to keep battery tops dry, prevent the escape of electrolyte from the cell and eliminate subsequent damage to the battery and its compartments.

On the underside of the cap section is a flexible neoprene baffle which fits snugly into the filling opening of the adapter, making a tight seal. When the cap is closed, it automatically latches, preventing cap from opening when electrolyte in the cell surges or when batteries are hosed down with air or water. According to the manufacturer, vertical shock and vibration will not open it, yet the cap is easy to open in order to service the cells. A flip of the finger under the cap handle is all that is required.

This vent cap has a condenser chamber between the baffle and the underside of the cap. Gas passes into this chamber where it is condensed and the moisture passes back into the cell. The adapter flange of the cap is designed for use in all cell covers having the 3¼-in. diameter threadless vent opening.

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Automatic Slack Adjuster

The Gustin-Bacon automatic slack adjuster was designed and developed, according to the manufacturer, to maintain the desired brake cylinder piston travel on freight cars (except hopper cars) with the least possible alteration to the foundation brake rigging, and at the same time, be easy to install, simple and safe to release when necessary to apply new shoes, and sturdy enough to run from one cleaning period to the next without special attention.

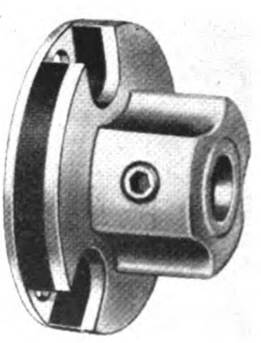
No additional material is required when applying these automatic slack adjusters to new cars, it is stated. The assembly is bolted to the non-pressure head of the brake cylinder and connected to the hand brake pull rod clevis. Total weight of the complete assembly is 80 lb.

To reset the G-B automatic slack adjuster only one operation is required—pull the operating handle toward the brake cylinder to full release position. The indexing ratchet and the master ratchet automatically reset themselves. There is no need for the car men to go between the rails or lie down, or sit down underneath the car. There is no readjustment whatever to be made between periodical cylinder cleaning dates. The possibility of short piston travel is practically eliminated because it would be very difficult, if not impossible, to make repairs without resetting the adjuster.

The G-B automatic slack adjuster is designed for a location that is in full view of car men. It is readily accessible, and is kept clean of dirt because of its "wide open" construction, and because no lubrication is required or desired. When brakes are first applied, after the original setting, the slack adjuster indexes on the master ratchet, taking up all accrued slack. Upon the next application it readjusts to predetermined piston travel in one stroke. Only one application of the brakes is required to take up all slack. If for any reason the slack adjuster should fail, the brake system merely reverts to the normal braking operation without benefit of the automatic take-up.

This automatic slack adjuster is a product of Gustin-Bacon Manufacturing Company, Kansas City, Mo.

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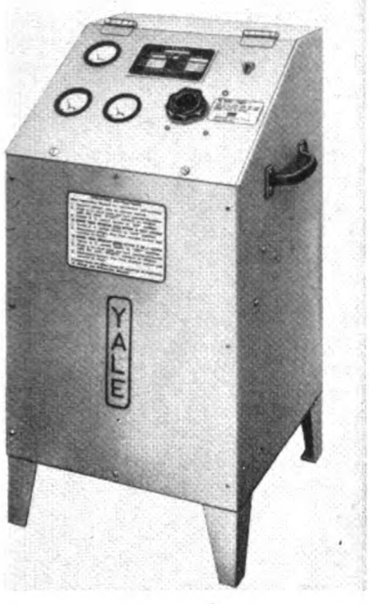
Fan-Noise Damper

A bonded neoprene hub has been produced by the Lord Manufacturing Company, Erie, Pa., for preventing motor noise from being transmitted to the fan driven by the motor. Investigation by Lord engineers showed that although the motor mounts were doing a satisfactory job of isolating motor noise from the mount or cabinet, they did not prevent noise from being carried through the motor shaft

into the fan blades and from there into the air stream.

The hub which has been developed to prevent such transmission of noise consists of a stamped aluminum washer and a zinc die-casting between which is bonded neoprene of proper stiffness to insure fan stability and maximum vibration isolation. Three rivets through the aluminum washer attach the hub to the fan, and a single socket-head, set screw in the die-casting attaches it to the motor shaft. There is no metallic path for vibration to follow, and the neoprene forms an effective "sound dam" between the shaft and fan.

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Battery Charger for Industrial Trucks

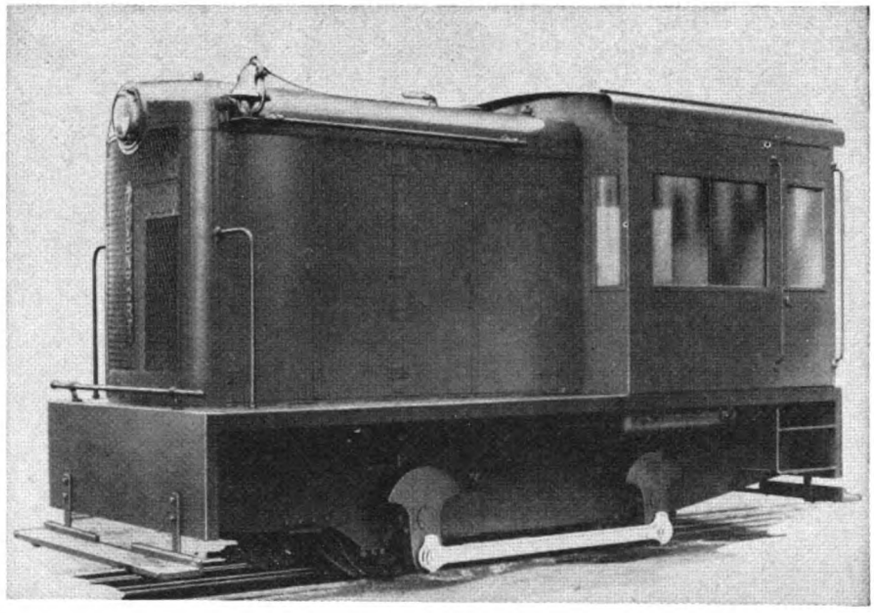
An industrial battery charger for units up to 55 amp.-hr. capacity is available from the Philadelphia Division, Yale & Towne Manufacturing Company. Operated on the selenium rectifier principle, the new charger is designed to give simplified maintenance free operation, prolong battery life, and save power. These results are accomplished primarily by an automatic controller with no moving parts which governs the amount and time of charge.

Manual operations are reduced to a minimum. To charge a battery, it is only necessary to plug it in, set the clocks and throw a switch.

There are no moving parts to maintain. Extra large rectifier plate area obviates the need for a fan and there are no commutators or brushes.

A dual clock control affords identical protection to both new and old batteries, whether fully or partially charged either in a cold or warm area. To accomplish this, temperature compensation is built into the charger.

Available for either lead-acid or nickel-alkaline batteries, the charger can be plugged into any standard 110/115-volt, 60-cycle outlet. No special wiring is necessary. A step-down transformer is furnished for 220-volt outlets. Other capacities for larger batteries will be available in the near future.



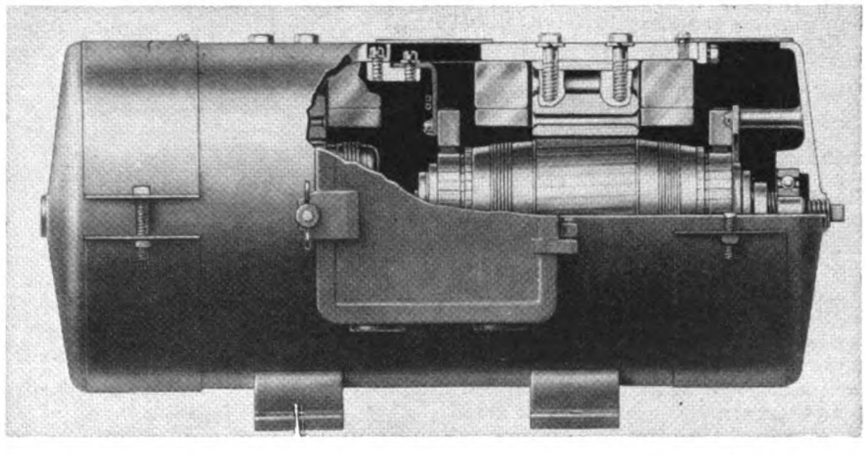
Davenport Torque-Converter Locomotives

A new series of diesel-powered industrial locomotives with torque-converter drive has been announced by the Davenport Locomotive Division, Davenport Besler Corporation, Davenport, Iowa, manufacturers of Davenport and Porter locomotives.

These hydraulic-drive locomotives are obtainable in a range of sizes and gages to meet individual operating conditions. They may also be equipped for gasoline-engine drive, if desired.

The locomotive in the illustration is 20-tons, 24 in. gage, and was built for a tie-treating company. It is equipped with a No. 6080 General Motors diesel engine and an Allison torque converter.

Among the benefits claimed for torque converter drive are smooth, quiet transition from one speed level to another; absence of engine slowdown during speed changes, freedom from the transmission of load shocks or jerks which make for wear and tear on mechanical parts and assurance of easier operation and greater work output.

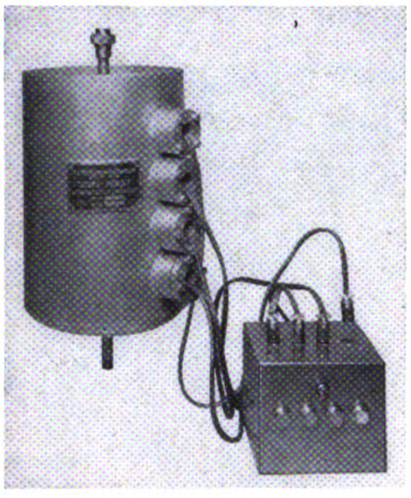


Alternator and M.G. Sets

Single or dual voltages for cab signalling and train communication can be provided through a complete line of motor generator and motor alternator sets introduced by the Safety Car Heating & Lighting Co., New Haven, Conn. Motors of these units are designed for nominal voltages of 32, 64 and 115 volts found on railway equipment. Depending on operating requirements, output can be either single or dual

voltage, at the desired value. Where a.c. power is required, radio noise filters are included as an integral part of the motor generator sets.

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Drinking Water Sterilizer

The powerful bactericidal rays of ultraviolet light are utilized to kill all harmful bacteria in drinking water flowing through the No. 7 UV water sterilizer introduced by the McDonald Company, Boston, Mass. Its stainless steel reservoir is connected in the drinking water supply line. All water drawn flows past a series of ultraviolet Sterilamps, the number depending on the demand.

The sterilizer device operates on 110 volt, 60 cycle a.c. supply. A pilot light is provided for each of the Sterilamps which provides visual indication that each lamp is functioning. The pilot light network and transformers for starting and running are housed in a stainless steel control unit.

This model is designed to provide drinking water for a standard diner of 36-48 seat capacity. Other models are built to order according to requirements.

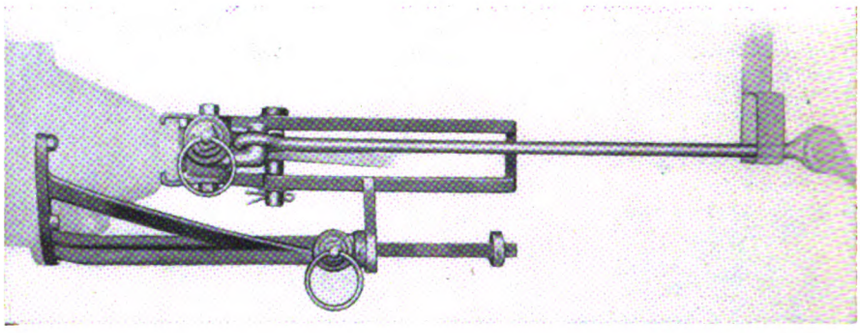
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Teflon Coated Fiberglas

The Irvington Varnish & Insulator Company, Irvington, N. J., has placed Teflon-coated Fiberglas on the market. Teflon is a DuPont plastic which, when applied to Fiberglas cloth, makes an electrical insulating material, which meets Class H requirements for high-temperature operation. It has been successfully employed by a number of electrical manufacturers as a coil separator, slot liner and coil wrapper in motors and generators. Its unusual resistance to chemical attack makes it particularly suitable for use in equipment designed to operate in corrosive atmospheres.

In other than electrical applications, the smooth, non-adhesive surface of Teflon-coated Fiberglas opens the way for applications that bring it into contact with sticky materials. Applied as a coating on belts, conveyors and rollers, it allows such materials to be handled easily and efficiently. It can also be used in the form of high-temperature gaskets for chemical applications, where it offers the advantages of chemical inertness and very low moisture absorption.

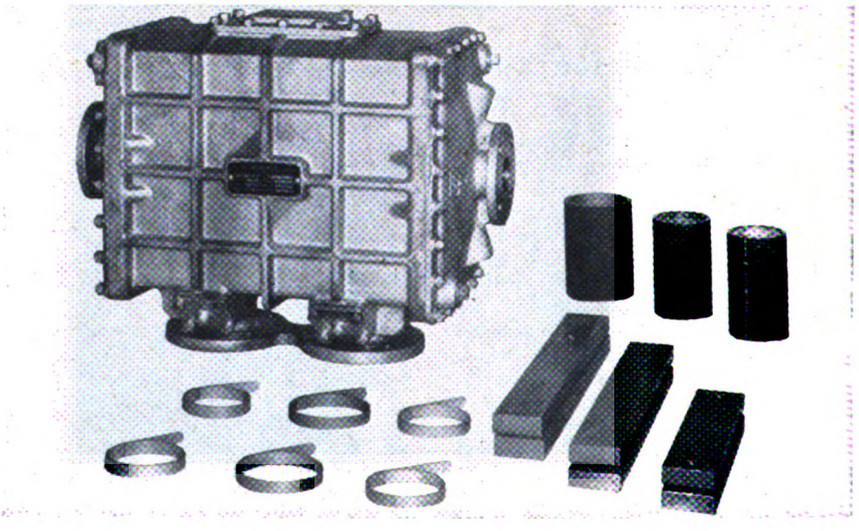
Teflon-coated Fiberglas is available in thicknesses from .003 in. to .010 in. The standard width is 38 in. untrimmed and tapes can be slit to specification in widths as narrow as ¼ in.



Adjusts Brake Slack Automatically

A simplified automatic brake slack adjuster for freight cars has recently been announced by the Locomotive Finished Material Company, Atchison, Kan. It is designed to take up the slack caused by brake shoe wear by lengthening the push rod in the air cylinder automatically. The outstanding feature, according to the manufacturer, is its unusual simplicity of design, installation and operation. It is completely automatic, positive acting, with no manual adjustments throughout the life of the brake shoes.

When shoes become worn, the carman merely pulls the two release rings which return the spring-operated adjuster to its original position, thus eliminating the danger of climbing under cars to make manual adjustments. Even if all shoes should become fully worn down, or fall off, this new adjuster will stop the car by maintaining proper braking force on the brake head, the manufacturer says. One man can apply the slack adjuster in a short time without special equipment or drilling of holes, and no further servicing is required.

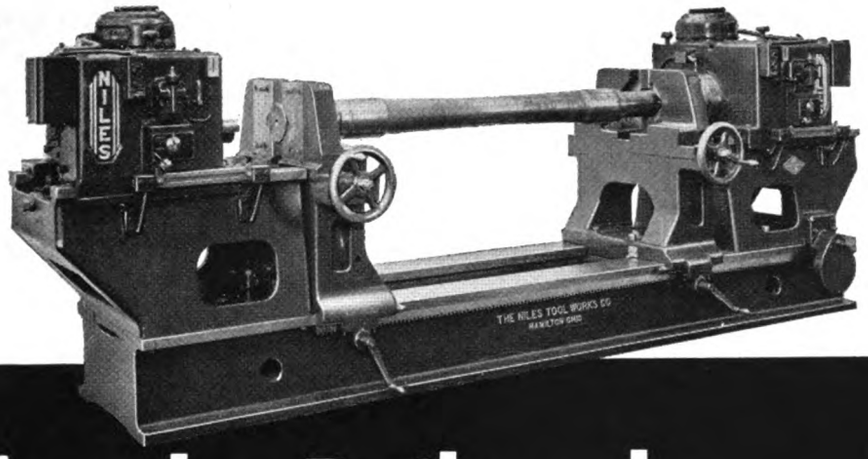


Oil Cooler for 70-Ton Locomotives

A complete kit for modernizing the cooling system of diesel-electric locomotives not equipped with dynamic braking has been announced by the General Electric Company's Locomotive and Car Equipment division. The kit consists of a new water-type engine oil cooler system, complete with oil cooler supports, oil and water hoses, hose clamps and drawing.

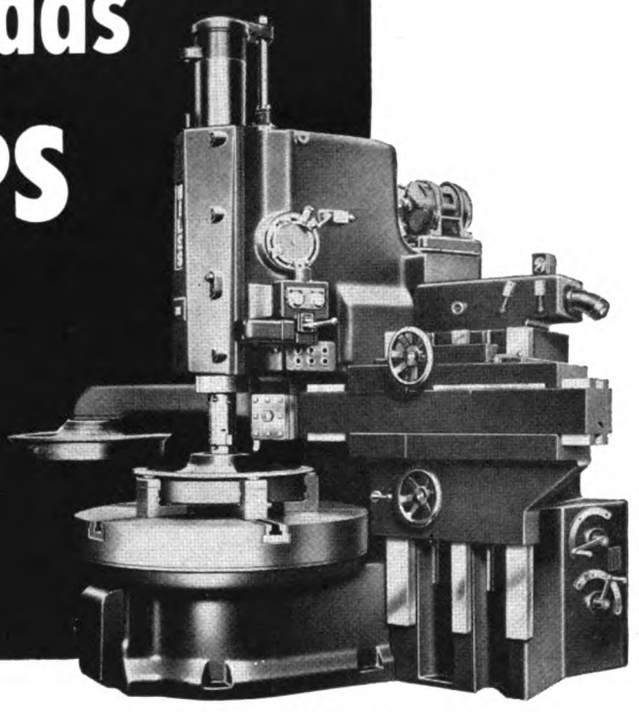
The cooler has been designed to replace the present air-cooled engine cooling system. It is furnished to supply better year-

(Continued on page 102)

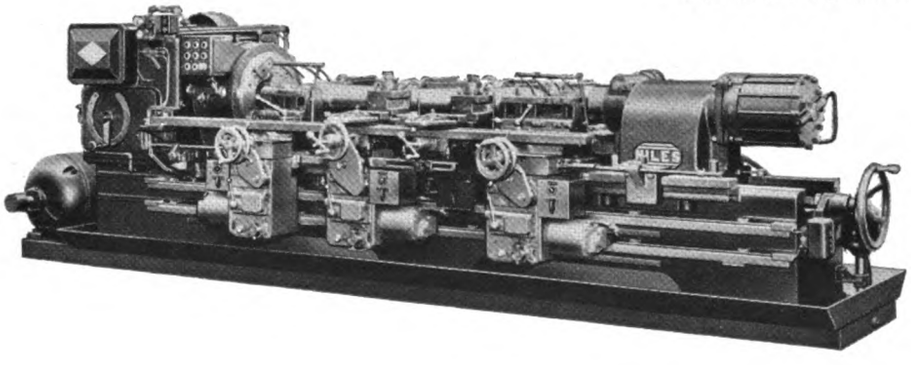


NILES Hydraulic Centering Machine. Centers new axles or renews centers on mounted or unmounted axles prior to turning. Permits easy checking of individual and related concentricity. Action is automatic. Assures high production and uniform dimensional results.

for the Railroads
for the SHOPS
TOOLS



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NILES End Drive Axle Lathe. Developed after extensive research, to speed up this key operation. Machines axles over their entire length in ⅓ to ½ the time ordinarily required. Leaves no indentation from driving jaws.

LIMA-HAMILTON

OFFICES IN PRINCIPAL CITIES

NEWS

Mechanical Division to Speed Up Freight Roller Bearing Development

Railway Mechanical and Electrical Engineer has learned that the Mechanical Division of the Association of American Railroads, is taking steps necessary to speed up the development of roller bearings suitable for application to freight-car journals. The objective is to set up designs and standards for freight-car roller-bearing applications which will meet all interchange requirements. It is understood that a study will be made of the experience of the railroads with passenger cars equipped with roller bearings as well as the experience of railroads which already have roller-bearing installations on freight cars.

The question of per diem adjustments to compensate car owners for the additional cost of building freight cars equipped with roller bearings is to be brought to the attention of the Operating-Transportation Division of the A.A.R.

Present research activities to improve the performance of plain journal bearings are to be continued and such improvements in journal boxes as will be applicable to existing cars which may be expected to complete their service life with plain-type bearings will continue to receive consideration.

Diesel-Electric's Fuel-Cost Advantage Emphasized Again by 1951 Figures

Advantages of diesel-electric locomotives from the standpoint of fuel costs were emphasized again in figures presented by the Interstate Commerce Commission's Bureau of Transport Economics and Statistics in the latest issue of its "Monthly Comment." The figures, covering this year's first four months, show that diesel-electrics then handled nearly half of the road freight service, nearly two-thirds of the yard service, and about 60 per cent of the passenger service, while accounting, respectively, for only 30.8 per cent, 33.4 per cent, and 46.3 per cent of total fuel costs involved.

The analysis of railway fuel costs included two tables, which are reproduced here from the "Comment." In addition to the diesel figures noted above, the data show comparative figures as to services performed and fuel costs incurred by other types of locomotives.

Also, there are the unit-cost figures which show that the fuel cost of performing 1,000 gross ton-miles of road freight service by diesel was 16.6 cents, compared with 33.4 cents and 40.1 cents for coal and oil-burning steam locomotives, respectively. The passenger-service figures are similarly favorable to the diesel, while the yard-service figures are even more favorable.

Allocations Contemplate 9,500 Cars per Month

Steel allocations in the current quarter "should be sufficient for construction in the fourth quarter of about 26,000 freight cars and 2,500 tank cars" the National Production Authority has announced. The third-quarter allocations total 597,000 tons of carbon steel, including 70,000 tons for the tank cars.

A fourth-quarter production of 28,500 cars, which N.P.A. thinks it has provided for, would be a 9,500-car monthly program. The N.P.A. announcement quoted "N.P.A. officials" as having said that this would be "as close to the proposed production of 10,000 cars a month as the short steel situation will permit."

The announcement also gave the monthly car-production figures for this year's first six months, the May and June totals having been 9,774 and 9,644 cars, respectively. The third-quarter alocations are expected to permit maintenance of this "near-10,000 per month level," N.P.A. said again.

The announcement had previously stated that freight car building "takes large quantities of wide steel plate, which is in very short supply." It was explained further that "steel bars and alloy steel are also extensively used and are also in very short supply." The announcement then added: "Since substitutions are in most cases impossible, production of freight cars will continue to be geared to available supplies of steel."

Meanwhile, as the announcement put it, "N.P.A. emphasized" that "production of freight cars is recognized as an important program"; and, "in addition to set-asides for steel, some producers are receiving spot assistance from N.P.A. to assure an orderly flow of production.

Shortages of Alloy Steel Halting Diesel Production

The National Production Authority has been advised by its Locomotive Builders Advisory Committee that "shortages of alloy steel are causing shutdowns of some plants constructing diesel-electric locomotives." This was announced in an N. P. A. statement, reporting on the committee's

SERVICE PERFORMED BY YARD AND TRAIN SERVICE LOCOMOTIVES AND COST OF FUEL CONSUMED — CLASS I ROADS (INCLUDING SWITCHING AND TERMINAL COMPANIES)

First 4 months of 1951—Basic figures in thousands

Kind of locomotive	Yard service: Yard switching locomotive hours	Yard service: Percent of total	Road freight service: Gross ton-miles, including locomotive and tender	Road freight service: Percent of total	Road passenger service: Passenger train car-miles[1]	Road passenger service: Percent of total
Coal burning—steam	5,537	28.8	209,338,456	39.4	235,591	21.6
Oil burning—steam	1,041	5.4	56,331,154	10.6	134,358	12.3
Diesel—electric	12,404	64.6	255,640,371	48.1	651,301	59.8
Electric	231	1.2	9,873,332	1.9	68,962	6.3
Total	19,213	100.0	531,183,313	100.0	1,090,212	100.0
			Fuel cost			
Coal burning—steam	$13,571	53.0	$69,919	50.7	$13,429	31.8
Oil burning—steam	3,223	12.6	22,589	16.4	6,718	15.9
Diesel-electric	8,546	33.4	42,436	30.8	19,539	46.3
Electric	259	1.0	2,873	2.1	2,552	6.0
Total	25,599	100.0	137,817	100.0	42,238	100.0

[1] Locomotive propelled trains.

FUEL CONSUMED AND COST PER UNIT OF TRAFFIC — CLASS I ROADS (INCLUDING SWITCHING AND TERMINAL COMPANIES)

First 4 months of 1951

Fuel and power consumed:	Quantities consumed	Cost per unit of traffic[2]
Per yard switching locomotive hour:		
Pounds of coal (steam locomotives)	932	$2.451
Gallons of fuel oil (steam locomotives)	70.67	3.096
Gallons of diesel fuel (diesel locomotives)	7.05	.689
Kilowatt-hours (electric locomotives)	112	1.123
Per 1000 gross ton-miles—road freight service:[1]		
Pounds of coal (steam locomotives)	127	.334
Gallons of fuel oil (steam locomotives)	9.15	.401
Gallons of diesel fuel (diesel locomotives)	1.7	.166
Kilowatt-hours (electric locomotives)	29.06	.291
Per passenger-train car-mile—road passenger service—locomotive propelled trains:		
Pounds of coal (steam locomotives)	21.7	.057
Gallons of fuel oil (steam locomotives)	1.15	.050
Gallons of diesel fuel (diesel locomotives)	0.31	.030
Kilowatt-hours (electric locomotives)	3.7	.037

[1] Represent gross ton-miles including locomotives and tenders.
[2] Includes cost of fuel, including freight and handling charges.

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NC 24-7215	2 x 2¼ x ¾	(⅜-⅜)	"Plytek" Grade AZY
NC 24-7213	2 x 2¼ x ¾	(⅜-⅜)	"Plytek" Grade AX-5
NC 24-5620	2 x 1¾ x ¾	(⅜-⅜)	"Plytek" Grade AZY
NC 20-6420	2⅛ x 2 x ⅝	($\frac{5}{16}$-$\frac{5}{16}$)	"Plytek" Grade AZY
NC 20-6419	2⅛ x 2 x ⅝	($\frac{5}{16}$-$\frac{5}{16}$)	"Plytek" Grade AJH

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* **ACCORDING TO CUSTOMERS' REPORTS AS OF JUNE 26, 1951**

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July 6 meeting in Washington, D. C.

The announcement also said that "N. P. A. and the committee agreed that the railroad industry cannot be expected to move defense freight on schedule unless new diesel locomotives are provided."

R. L. Glenn, acting director of N. P. A.'s Railroad Equipment Division, presided at the committee meeting, which was held "to consider methods of conserving critical materials used in locomotive production." On that phase of the meeting, N. P. A.'s press release made this report:

"Large quantities of copper are used but little of it can be substituted for or conserved, members said. Several builders said they are attempting to substitute boron-treated steel for some scarcer alloys but are finding it impossible to get shipments of boron steels.

N.P.A. Sets Up M.R.O. Plan for Railroads

THE National Production Authority on June 28 issued Order M-73 which sets up special arrangements for the distribution of controlled materials to railroad transportation systems for maintenance, repair and operating supplies. Railroad M.R.O. allocations were previously covered by N.P.A.'s Regulation 4 which maintains the M.R.O. set-up applicable to industry generally.

M-73 supersedes Regulation 4 insofar as the latter has applied to railroad companies using more than $25,000 worth of M.R.O. materials in a quarter. As for the under-$25,000 companies, they get the option of operating under either order.

Under the provisions of Order M-73, each road will list it quarterly M.R.O. requirements on a prescribed form NPAF-105. The listings will cover the M.R.O. portion of the present freight-car program as well as requirements for the maintenance of fixed facilities.

N.P.A. suggested that the making of allotments would be "easier" if requirements for all types of work covered were consolidated into one report. The allotments will be "based on the availability of supplies and subject to program determinations by the Defense Production Administration," N.P.A. also said. It had previously noted that the principal controlled-materials item involved in the quarterly distribution will be about a million tons of carbon steel.

N. P. A. said that boron and vanadium steels are in good supply and officials promised to investigate conflicting reports on the availability of boron steel."

It was also reported that "N. P. A. officials said they would consider steps to relieve the pressing shortage of steel for locomotive builders."

John Morris Gets Diesel Award

In recognition of his leadership in diesel locomotive development in this country, J. P. Morris, general manager, mechanical, Atchison, Topeka & Santa Fe, was awarded

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of March 1951	Month of March 1950	3 months ended with March 1951	3 months ended with March 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	28,995	29,197	82,443	78,496
3-06	Total, Diesel-electric	22,032	16,974	60,967	46,871
3-07	Total, electric	878	891	2,415	2,335
3-04	Total, locomotive-miles	51,915	47,071	145,831	127,713
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,851	1,599	5,110	4,217
4-06	Empty, total	925	830	2,450	2,285
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	49,499	48,538	138,800	119,632
6-02	Total in oil-burning steam locomotive trains	13,371	11,803	35,497	32,803
6-03	Total in Diesel-electric locomotive trains	62,053	48,118	169,111	130,919
6-04	Total in electric locomotive trains	2,434	2,311	6,610	5,956
6-06	Total in all trains	127,400	110,799	350,093	289,352
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.05	1.05	1.05
10-02	Loaded freight car-miles	39.60	38.20	39.10	36.80
10-03	Empty freight car-miles	19.80	19.90	18.70	20.00
10-04	Total freight car-miles (excluding caboose)	59.40	58.10	57.80	56.80
10-05	Gross ton-miles (excluding locomotive and tender)	2,725	2,649	2,676	2,528
10-06	Net ton-miles	1,263	1,218	1,253	1,128
12	Net ton-miles per loaded car-mile (M-211)	31.90	31.90	32.10	30.60
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	66.70	65.80	67.60	64.90
14	Averages per train hour (M-211):				
14-01	Train miles	16.90	16.60	16.60	17.00
14-02	Gross ton-miles (excluding locomotive and tender)	45,410	43,296	43,935	42,304
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	48.50	44.30	45.40	40.70
14-02	All	46.40	41.10	43.30	37.70
15	Average net ton-miles per freight car-day (000) (M-240)	986	863	940	749
17	Per cent of home cars of total freight cars on the line (M-240)	35.80	43.60	34.90	48.80
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	11,404	11,241	34,229	32,592
3-06	Diesel-electric	16,189	14,538	46,231	41,649
3-07	Electric	1,706	1,647	4,851	4,755
3-04	Total	29,300	27,426	85,311	78,996
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	285,378	264,851	821,015	765,490
4-09	Total in coal-burning steam locomotive trains	60,888	57,681	181,791	162,314
4-10	Total in oil-burning steam locomotive trains	34,533	34,687	101,872	104,796
4-11	Total in Diesel-electric locomotive trains	171,356	154,407	485,680	446,222
12	Total car-miles per train-miles	9.60	9.39	9.51	9.43
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,406	1,476	4,089	4,086
1-02	Steam, oil-burning	263	231	740	667
1-03	Diesel-electric[1]	3,036	2,418	8,557	6,812
1-06	Total	4,733	4,153	13,468	11,643
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	54	63	161	190
2-02	Steam, oil-burning	14	14	41	40
2-03	Diesel-electric[1]	250	226	712	660
2-06	Total	354	338	1,014	992
3	Hours per yard locomotive-day:				
3-01	Steam	8.40	7.70	8.40	7.30
3-02	Diesel-electric	18.20	17.60	17.80	17.30
3-05	Serviceable	14.90	14.20	14.70	13.70
3-06	All locomotives (serviceable, unserviceable and stored)	12.90	11.60	12.70	11.20
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.76	1.80	1.82	1.90
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.77	0.79	0.77	0.80

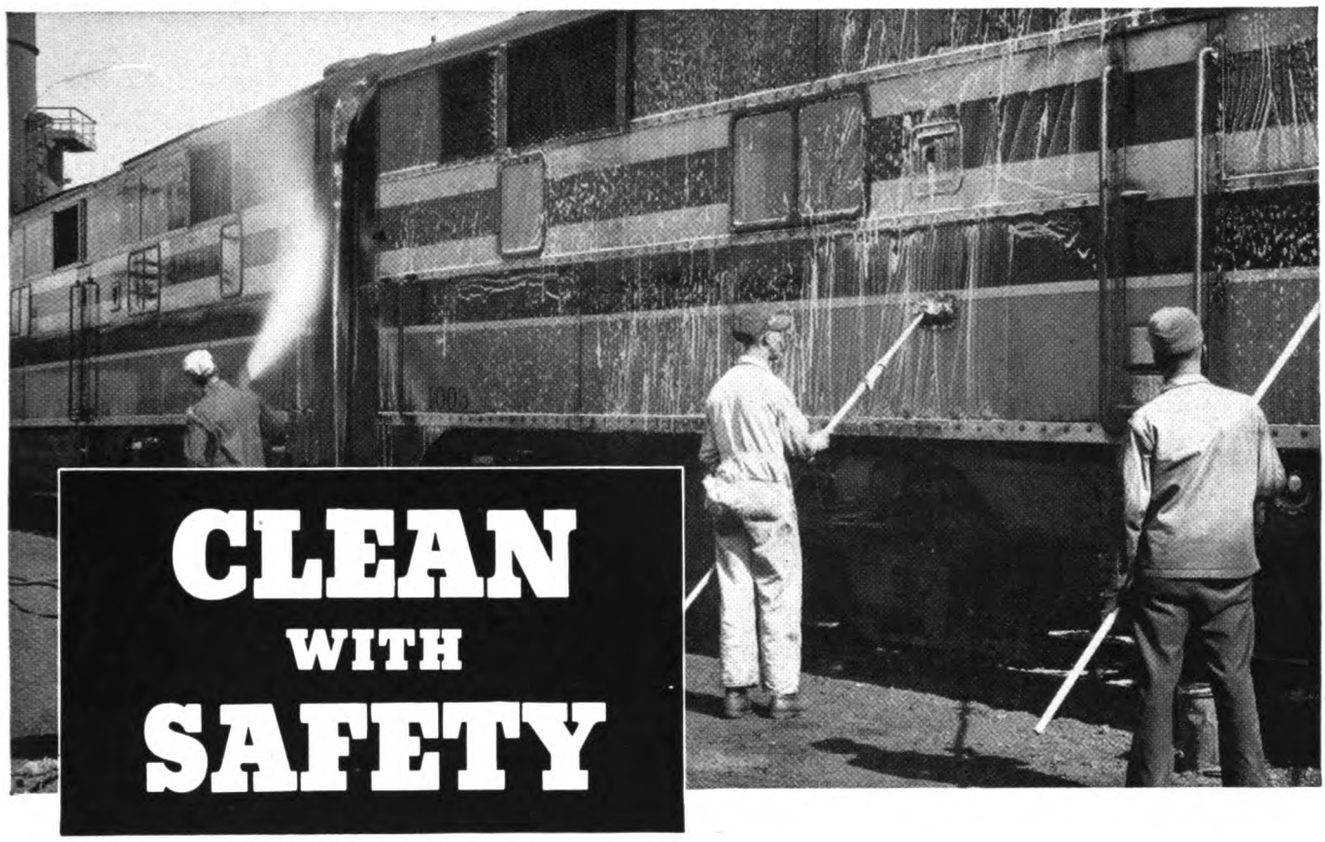
[1] Excludes B and trailing A units.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE JULY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horsepower*	*Service*	*Builder*
Baltimore & Ohio	8[1]	1,200	Switch	Electro-Motive
	18A	1,500	Freight	Electro-Motive
	9B	1,500	Freight	Electro-Motive
	6A	1,600	Freight	Alco-G. E.
	3B	1,600	Freight	Alco-G. E.
	2A	1,600	Freight	Baldwin-Lima-Hamilton
	1B	1,600	Freight	Baldwin-Lima-Hamilton
	5	1,600	Road switch	Baldwin-Lima-Hamilton
Chicago, Milwaukee, St. Paul & Pacific	08[2]	1,500	Freight	Electro-Motive
	18	1,500	Passenger	Electro-Motive
	12	1,500	Road switch	Electro-Motive
	3	1,200	Switch	Electro-Motive
	10	1,200	Switch	Fairbanks, Morse
	10	1,000	Switch	Alco-G. E.
	7	1,200	Switch	Baldwin-Lima-Hamilton
Lehigh & Hudson River	2[3]	1,600	Road switch	Alco-G. E.
Maine Central	1[4]	1,200		Electro-Motive
	1	1,500		Electro-Motive
New York, New Haven & Hartford	10[5]	1,600	Road switch	Alco-G. E.
	5B	1,600	Road freight	Alco-G. E.
Northern Pacific	3[6]	1,200	Switch	Electro-Motive
	4	1,500	Road switch	Electro-Motive
	1B	1,500	Freight	Electro-Motive
	4A	1,500	Freight	Electro-Motive
	4B	1,500	Freight	Electro-Motive
	2A	1,500	Passenger	Electro-Motive
	1B	1,500	Passenger	Electro-Motive
	4	1,000	Switch	Alco-G. E.

(Continued on p. 110)



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■ **INTERIOR CLEANERS.** Detergent and solvent type materials for interior cleaning of Diesel locomotives, passenger and baggage cars, roundhouses and offices. Designed for safety and economy.

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■ **HOT TANK CLEANERS.** For use on steam locomotive side rods, wheels and other parts that become heavily coated with grease and dirt. Also long life materials for cleaning air filters, oil and sintered bronze filters and specialized formulas for non-ferrous metals.

■ **ELECTRICAL PARTS CLEANERS.** A special solvent of low toxicity for spray cleaning of electrical cabinet interiors, relays, motor windings, other electrical equipment. Removes tarnish and oily film. Will not harm insulation.

■ **SCALE REMOVER CLEANERS.** For removing scale from Diesel cooling systems with acid pump. A ferrous cleaner, it may be safely used for cleaning units constructed of copper, bronze, brass or their alloys.



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Railroad.....

Address.....

City.....*State*.....

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE JULY ISSUE *(cont'd.)*

Richmond, Fredericsburg & Potomac	6[7]	2,250	Road	Electro-Motive
Texas & Pacific	6[8]	1,500	Freight	Electro-Motive
	6	1,500	Road switch	Electro-Motive
	8	800	Switch	Electro-Motive

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Baltimore & Ohio	500[1]	70-ton covered hopper	Greenville Steel Car
Denver & Rio Grande Western	1,000[9]	70-ton gondola	General American
Department of the Army	418	50-ton box	Pullman-Standard
New York, New Haven & Hartford	55[05]	70-ton hopper	Pullman-Standard
St. Louis-San Francisco	100[10]	50-ton pulpwood	Company shops
Wabash	1,000[11]	50-ton box	American Car & Fdry.
	300	50-ton box	General American

FREIGHT-CAR INQUIRIES

Denver & Rio Grande Western	25	70-ton covered hopper
Detroit, Toledo & Ironton	100	70-ton covered hopper

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
New York, New Haven & Hartford	1	Diesel rail	Mack Trucks
Union Pacific	16	Sleeping	American Car & Fdry.
	2	Dining	American Car & Fdry.
	2	Dormitory-kitchen	American Car & Fdry.
	4	Dining	American Car & Fdry.
	14	Coaches	American Car & Fdry.
	10	Baggage	American Car & Fdry.
	2	Railway postoffice	American Car & Fdry.

[1] The eight 1,200 switchers are scheduled for delivery beginning in November and for use on the Baltimore & Ohio Chicago Terminal. Cost, about $840,000. Six of the other electro-motive units are scheduled for delivery in the first quarter, and 21 in the third quarter of 1952. The Alco-G. E. units are for delivery in February 1952. The B.-L.-H. freight units are scheduled for delivery next April and the road-switching units next February. Delivery of the hopper cars is expected to begin during the third quarter of 1952.

[5] For delivery between September 1951 and May 1952.

[8] Approximate cost, $294,000. One unit scheduled for delivery in July and one in October.

[6] The 1,200-hp. unit is scheduled for delivery in August and the 1,500-hp. unit in October.

[5] The locomotives are scheduled for delivery in November and December. The self-propelled diesel rail car will be equipped with a Mack bus body, P.C.C. street car trucks and diesel-electric power. It will have a capacity of about 45 passengers. The New Haven is also equipping 65 baggage cars for express messenger and baggageman service. The hopper cars will cost about $3,465,000.

[6] Deliveries scheduled to begin next April and be completed the following October.

[7] Approximate cost, $1,450,000. Two locomotives scheduled for delivery next January and the third in July 1952.

[8] For delivery during the first quarter of 1952.

[9] Estimated cost, $7,000,000. Delivery scheduled for the third quarter of 1952.

[10] Construction scheduled to begin during the third or fourth quarter of this year, depending upon receipt of the necessary materials.

[11] Delivery of equipment in both orders expected during the second quarter of 1952.

NOTES:

Canadian National.—As a result of a study, completed in April, of equipment needs, the Canadian National has recommended that normal purchase for the next five years should include 4,360 new freight cars per year. Of this number, 2,500 would offset annual retirements for obsolescence and other causes; the rest are considered necessary to accommodate an estimated 10 per cent in business, at the rate of two per cent a year for the next five years. Approximately 30 new baggage cars a year will be needed to provide for average annual retirements and to bring this class of equipment to approved passenger train standards.

New York & Long Branch.—The New Jersey Board of Public Utility Commissioners has approved a $5,000,000 improvement program for Pennsylvania trains serving the north New Jersey coast via the New York & Long Branch. Included in the program for 1951 is complete overhauling of 23 steam locomotives and assignment of 10 additional modernized, air-conditioned coaches to supplement 48 similar cars now in service. Twenty more air-conditioned coaches will be added in 1952 and 20 more in the following year.

U. S. Army Transportation Corps.—Officers of the U. S. Army Transportation Corps have taken delivery of two new Unicel freight cars which have just been purchased. Col. Emil Ringberg, A.T.C., said the army plans to move the new cars to Fort Eustis, near Norfolk, Va., for additional tests which will be made as soon as possible because of the nation's urgent defense transportation needs. The results of official A.A.R. tests of the Unicel car being made on the Chicago, Milwaukee, St. Paul & Pacific, are expected to be made known shortly.

a bronze plaque at the regular June meeting of the St. Louis Railroad Diesel Club. The inscription on the plaque was worded as follows: "To John P. Morris, June 12, 1951—In recognition of his outstanding contribution to the advancement of the diesel locomotive. St. Louis Railroad Diesel Club."

In addressing the club, Mr. Morris reviewed early difficulties and experiences with diesel locomotives, described the important part the new power has played in rail transportation and emphasized the need for adequate servicing and repair facilities as well as organizations trained to secure maximum utilization. Illustrative of stepped-up maintenance requirements, he said that 210 diesel units in addition to 11 assigned units and 35 switchers are now being given running repairs at Argentine, Kan., where a 3.5-million-dollar modern heavy repair and maintenance diesel shop is scheduled for completion in 1953 with capacity for handling 600 units which will be required when that territory is completely dieselized.

A.A.R. Divisions May Go To Atlantic City in 1953

In connection with the Eighth Pan-American Railway Congress to be held in Atlantic City, N. J., during the week of June 19, 1953, plans are being considered for meetings at the same time and place ac- P. & S. Division to hold their 1953 annual the A.A.R. Mechanical Division and the companied by an extensive exhibit of railway equipment and supplies. The 1952 annual meetings of the two A.A.R. divisions mentioned are expected to be held in Chicago without exhibits.

More Time for AB Brake Installations

DIVISION 3 of the Interstate Commerce Commission has given railroads and other car owners more time to complete installation of AB brakes on their freight cars. A June 5 order in the No. 13528 proceeding set back the deadline date for six months—from December 31, 1951, to June 30, 1952.

The order will also prohibit movement after June 30, 1952, of any unequipped car owned by a railroad—"unless such car is received in interchange from a line other than the owning line or unless such car is moved over its own rails by an owning line." After December 31, 1952, any movement of any unequipped car "used in freight service (including the cars of private car line companies)" will be prohibited.

Miscellaneous Publications

ENGINEERING STANDARDS FOR MULTIPLE V-BELT DRIVE: Published by Rubber Manufacturers Association, 444 Madison avenue, New York 22, and Multiple V-Belt Drive & Mechanical Power Transmission Association, 7 West Madison street, Chicago 2. 16-page manual. Price, $1 or two copies. Contains recommended Standards as developed and approved by the technical committees of both associations. Indicates proper sheaves and belts to be used for optimum efficiency and economy of complete drive in relation to particular duty required.

SUPPLY TRADE NOTES

PRESSED STEEL CAR COMPANY. — The Pressed Steel Car Company has acquired the Chicago Steel Tank Company. The acquisition includes two subsidiary companies, Steel Erectors, Inc., which operates as a field installation arm of the parent company, and Conduit Fittings Corporation, makers of parts for electricial appliances and systems.

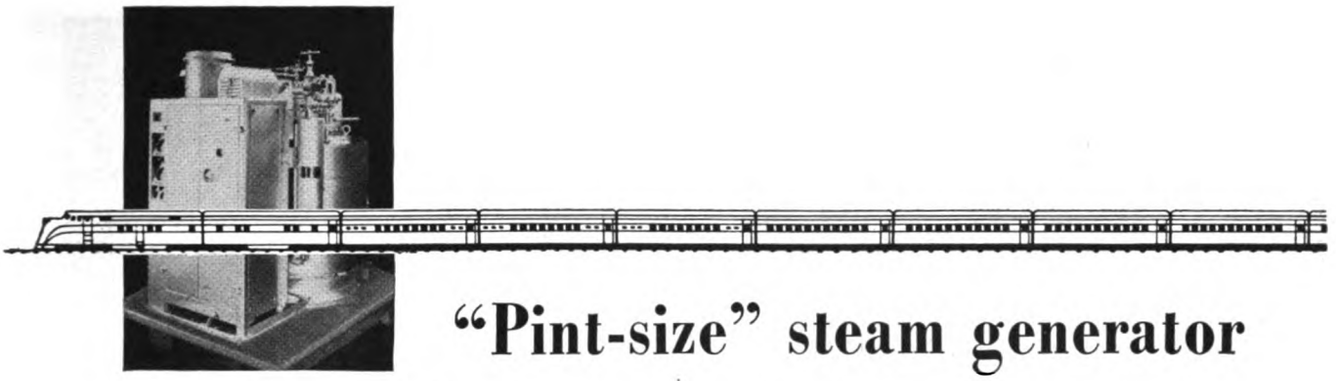
◆

HELI-COIL CORPORATION.—*Eugene M. Lang* has been elected vice-president in charge of manufacturing of the Heli-Coil Corporation of Long Island City, N. Y. *Louis K. Rimer*, former vice-president in charge of operations of Elgin American Company, Elgin, Ill., succeeds Mr. Lang as works manager and has been elected assistant secretary of the corporation.

Cr. Lang, former works manager at the Heli-Coil plant, has served the firm in various executive and production capacities since 1941. Prior to that time he was a management consultant to chemical and metal-fabricating firms and an industrial analyst for several trade publications.

◆

FARR COMPANY.—The new main factory and office building of the Farr Company in El Segundo, Cal., has been completed as has also the transfer of its factory on Southwest Drive in Los Angeles. Facilities in the new plant include executive and general offices, a research laboratory, an



"Pint-size" steam generator warms a whole diesel train

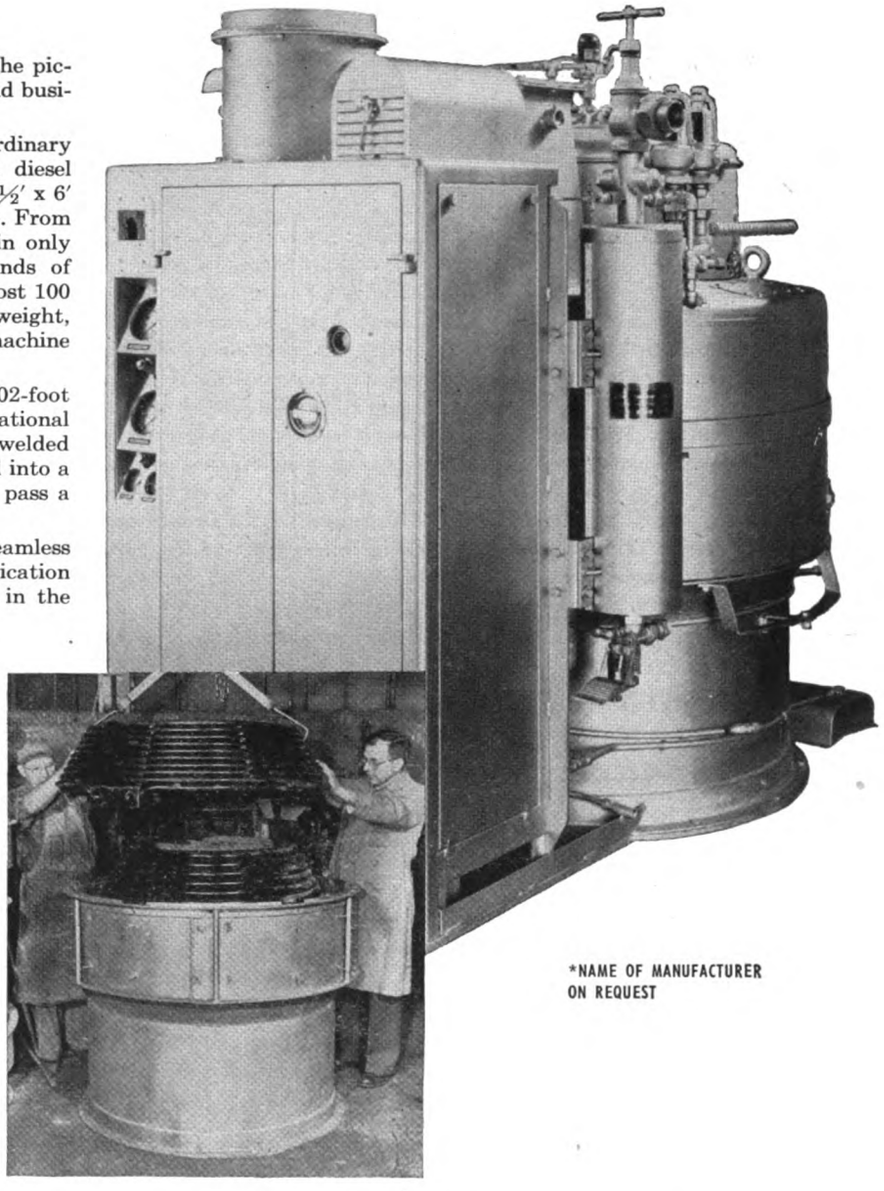
That Vapor-Clarkson steam generator* in the picture has caused a real stir both in the railroad business and out of it.

Even though it's no bigger than an ordinary clothes closet, it does the one big job a diesel locomotive can't do by itself—this 3½′ x 5½′ x 6′ generator can heat an entire train. Fast, too. From a cold start, it will deliver 200 psi steam in only two minutes. Capacity is over 4500 pounds of steam per hour. That's enough to heat almost 100 homes in dead zero weather. For size and weight, this is the most powerful steam-making machine developed by industry.

Heart of this ingenious generator is a 702-foot long set of continuous coils made from National Seamless Steel Tubing. Standard lengths are welded into 200 or 300 foot lengths, then cold rolled into a coil. All coils are interchangeable. All coils pass a 1200 pound hydrostatic pressure test.

This is another instance of National Seamless doing a fine job, despite the exacting fabrication methods and rigorous tests. The reason is in the tubing itself—in that magic word, "Seamless." There aren't any longitudinal welds to weaken the tube. Each tube is pierced from a solid billet of steel . . . the *one* method that removes all doubt concerning wall strength.

When planning the use of seamless pipe or tubing for future needs, be sure to specify National Seamless, made by the world's largest and most experienced manufacturer of tubular steel products.



*NAME OF MANUFACTURER ON REQUEST

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
(Tubing Specialties Division)
COLUMBIA STEEL COMPANY, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TRADE MARK

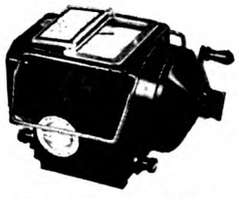
NATIONAL *Seamless* PIPE AND TUBES

UNITED STATES STEEL

BIDDLE

NUMBER 6 OF A SERIES

Instrument News



Hand-Operated Type



Dual-Operated Type



Rectifier-Operated Type

MEGGER® ELECTRICAL INSULATION TESTERS in Types to Suit Varying Railroad Needs

For checking control panels or motors of diesel-electric engines, checking electrical equipment on cars—for bench checking, or field checking—there's a Megger instrument specifically designed to save you time and serve you faithfully.

The Hand Crank Meg Type of Megger Insulation Tester is a reliable field instrument, light, sturdy, with constant-voltage type generator—no dependence on batteries or other current supply. Ranges to 2000 megohms, hand generators to 1000 volts d-c.

The Rectifier-Operated Meg Type of Megger Insulation Tester covers the same ranges as the hand crank model. It is most efficient for bench work—long tests or repetitive tests of a "production line" nature because it operates from a built-in rectifier that plugs into a convenient outlet.

The most versatile of the Megger family of instruments is the *Dual-Operated* Meg Type of Megger Insulation Tester. This can be a field instrument with hand crank, or instantly converted into a rectifier-operated instrument by handy plug-in rectifier connected to 115 v. 60 cycles outlet. Same ranges as other Meg Types.

For a complete picture of the Biddle line of Megger Instruments write for Bulletin 21-05-X.

IDEAL INSTRUMENT FOR GROUND RESISTANCE TESTS "OUT ON THE SYSTEM"

Meg Type of Megger® Ground Tester

A high-quality, rugged instrument that gives reliable ground resistance readings even in the hands of work crews and test men who are not experts in electrical instruments. It is direct-reading in ohms requiring no calculations. It has one set of connections for 3-terminal or 2-terminal tests, and an unfailing hand generator power source. Unaffected by stray current in the earth, or by polarization or electrolysis. The Meg Type of Megger Ground Tester is accurate to within 1/32 of an inch along its scale.



A three-terminal ground resistance test at a railway signal tower. Photo courtesy of Pennsylvania Railroad.

Available in 5 range scales from 0-300 to 0-3000 ohms. Furnished complete with test leads and reference ground rod. Dimensions of instrument are 5" x 9¼" x 6¼". Weighs about 8 lbs.

We shall gladly furnish to responsible prospects the names of railroads who have adopted these handy instruments for field crews. Write for list "X" . . . also Ground Tester Bulletin 25-X, and "Grounding Electric Circuits Effectively" by J. R. Eaton (Bulletin 25T2-X).

JAMES G. BIDDLE CO., 1316 ARCH ST.

PHILADELPHIA 7, PA.

ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT



B. Wilson

Double Seal Ring Company for the past eight years, has been appointed vice-president in charge of sales.

◆

EX-CELL-O CORPORATION.—*Donald H. McIver* who has been elected vice-president in charge of industrial sales, as announced in the July issue of *Railway Mechanical and Electrical Engineer* was born in Glasgow, Scotland, in 1906. He attended Cleveland, Ohio, schools and is a graduate of Ohio Northern University (1929) with the degree of Bachelor of Science in Mechanical Engineering. He joined Ex-Cell-O in 1929 and embarked upon an intensive two-year training program. In 1931 he was put in charge of the production control department until, in 1934, he moved to the sales department. He was appointed assistant to the vice-president in charge of sales in 1937, sales manager of the Precision Products division in 1947, and sales manager of the Industrial Division of Ex-Cell-O in 1949.

◆

AIRETOOL MANUFACTURING COMPANY.—The Airetool Manufacturing Company, Springfield, Ohio, has acquired the Ajax Expander Company of Fairview, Pa. The manufacturing facilities and inventory of Ajax have been moved to the Springfield plant where Airetool will continue to produce and stock the Ajax "Collins Type" and "C. B.," "P. R." and Linsen series of tube expanders.

◆

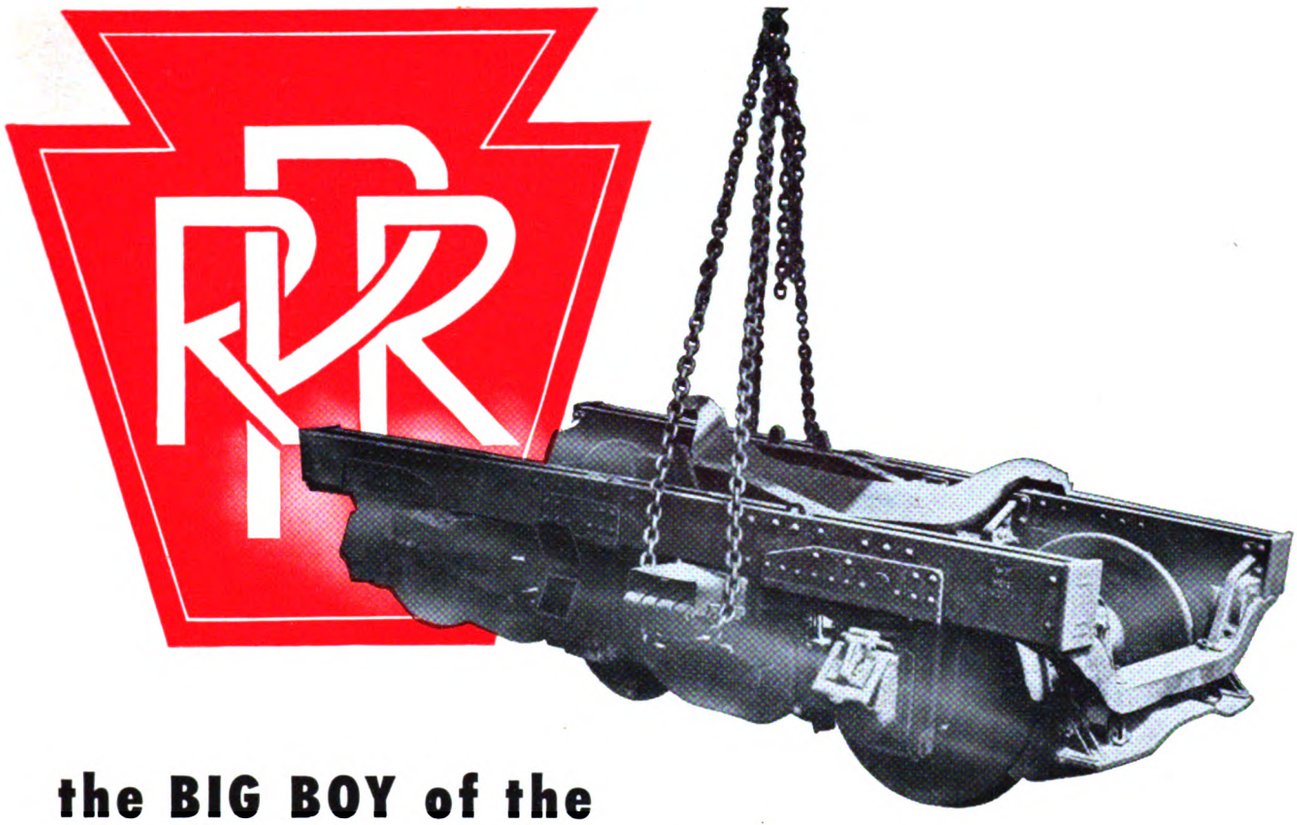
WESTINGHOUSE ELECTRIC CORPORATION.—The Westinghouse Electric Corporation recently opened a new office in the Merchandise Mart, Chicago. The firm's northwestern district headquarters were formerly located at 20 North Wacker drive.

◆

AMERICAN CAR & FOUNDRY CO.—*William M. Hawkins*, laboratory director at Berwick, Pa., has been appointed senior research engineer at New York in the research and development department. *George Reed*, manager of inspection, succeeds Mr. Hawkins at Berwick but with the title of manager, general laboratories. *Sheldon Thomas*, formerly resident representative at the Chicago plant, has been appointed manager of inspection, succeeding Mr. Reed.

◆

GRAYBAR ELECTRIC COMPANY.—*W. E. Guy*, district sales manager of the Graybar

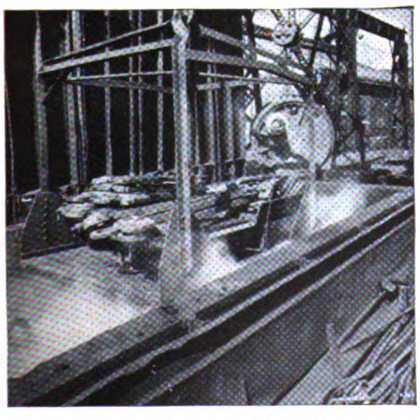


the BIG BOY of the railroads does a BIG cleaning job ...with PENNSALT CLEANER 45-X

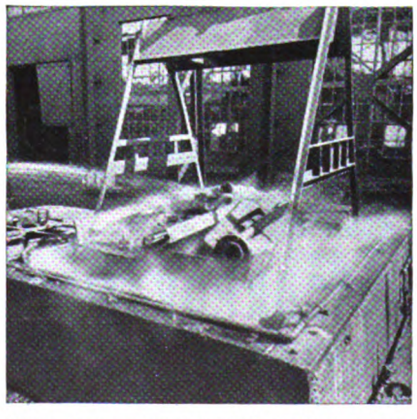
The Pennsylvania Railroad's Altoona, Pa., shops contain a battery of cleaning vats . . . including the largest soak cleaning tank in the world. Into these tanks goes a wide variety of locomotive and car parts, hard-caked with grime and road dirt. Within a matter of hours, out they come again . . . clean and ready for inspection and service.

For 11 years, the Pennsylvania has used Pennsalt Cleaner 45-X in this installation for tough cleaning operations. Especially designed for heavy duty work, 45-X is ideally suited for such railroad cleaning. It is concentrated, free-flowing, virtually anhydrous and has high emulsifying power. It is in use on many of the country's leading roads.

Pennsalt has thoroughly trained service representatives . . . well equipped to help you with your cleaning problems. They'll be glad to set up tests to determine how Pennsalt Cleaners may give you better, faster cleaning. Write to Maintenance Chemicals Dept., Pennsylvania Salt Manufacturing Company, Philadelphia 7, Penna.



A basket-load of main rods, side rods and valve gear stripped clean of grime and road dirt.



Hosing down a cleaned load of miscellaneous parts: crossheads, guides, brake beams, superheaters.

railroad maintenance cleaners by

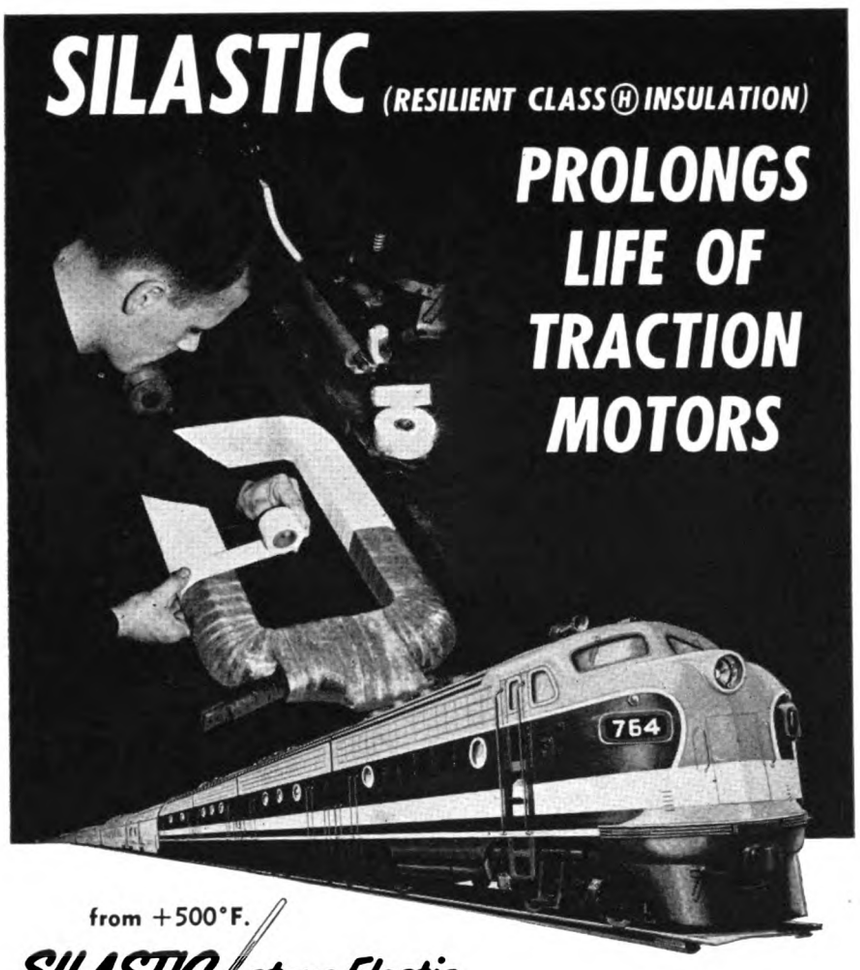
PENNSALT CHEMICALS

for Industry · Agriculture · Health · Home

Progressive Chemistry for over a Century

SILASTIC (RESILIENT CLASS (H) INSULATION)

PROLONGS LIFE OF TRACTION MOTORS



from +500°F.

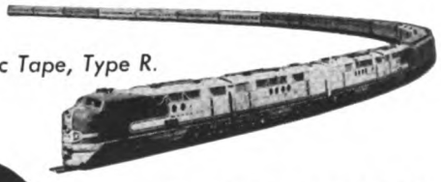
SILASTIC stays Elastic

to −100°F.

Now, for the first time since Benjamin Franklin tied a key to the tail of a kite, there's a rubbery insulating material that will withstand the heat generated in an overloaded motor. Available as Silastic Tape, Type R, these new insulating materials are easier to apply and form a longer lasting outer jacket than other kinds of insulation suitable for traction motor field coils.

Silastic Tape, Type R, vulcanizes to form a continuous void-free jacket that is moisture proof, stable and resilient at top Class H operating temperatures (180° C.), and highly resistant to oil and to both mechanical and electrical fatigue. Over 4200 main and interpole field coils insulated with Silastic Tape, Type R, are now in service on diesel-electric traction motors.

Many of these coils have been in service for more than 15 months with no failures reported even in the case of one locomotive that was suddenly thrown into reverse by a short circuited control panel. The cost is comparable to Class B coils; life expectancy is in the range of 10 to 1.



Write now for data on Silastic Tape, Type R.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

DOW CORNING SILICONES

Atlanta • Chicago • Cleveland • Dallas • Los Angeles • New York • Washington, D. C.
In Canada: Fiberglas Canada Ltd., Toronto • In Great Britain: Midland Silicones, Ltd.

Electric Company, at Chicago, has been appointed assistant district manager of the Chicago district; *L. C. Esthus*, branch manager at Des Moines, Iowa, has been appointed district sales manager at Chicago, succeeding Mr. Guy, and *D. M. Hitchcock*, of San Francisco, Cal., has been transferred to Des Moines to succeed Mr. Esthus.

◆

S. KARPEN & BROS.—A syndicate, headed by Jay Levine and David Berdon of New York, which is the principal shareholder of International Furniture Company, has purchased the business of S. Karpen & Bros., manuafcturers of transportation seating and other furniture. Terms of the sale were not made public.

"We will preserve the Karpen name in our merchandising, and we will continue the Karpen line of goods," Mr. Levine declared in announcing the transaction. He added that activities of International and Karpen, if approved by the stockholders, will be coordinated, but that two separate sales divisions will be maintained.

◆

EDGEWATER STEEL COMPANY.—*H. C. Riddile*, formerly general manager of Edgewater Steel, has been elected vice-president in charge of manufacturing. *B. T. Roe*, formerly vice-president of the Tracy Manufacturing Company whose assets Edgewater acquired recently, has been elected vice-president in charge of sales of the Tracy Division. *H. H. Solof*, formerly vice-president of Tracy has been elected assistant to the president. *B. J. Krywick*, formerly vice-president of Tracy, has been appointed general manager of the Tracy Division.

◆

NATIONAL STEEL CAR CORPORATION.—*Alex P. Shearwood* has been appointed vice-president of the National Steel Car Corporation of Montreal, Que., and Hamilton, Ont. as announced in the July issue of *Railway Mechanical and Electrical Engineer*.

Mr. Shearwood worked for the Dominion Bridge Company in 1927 and 1928 and for the Canadian Pacific in 1929 and 1930. He is a graduate of McGill University in arts



Alex P. Shearwood

(1930) and engineering (1932). In June 1932, he joined the engineering department of National Steel Car at Hamilton. He was transferred to the Montreal office in 1934 and was appointed mechanical assistant to the president in 1939 and general sales manager in 1947.

(Continued on p. 118)

NEW GRINDER SAFETY with GREATER POWER



No. 4 Series

INGERSOLL-RAND *introduces* ANOTHER BIG FIRST... *the* NEW OVERSPEED SAFETY COUPLING...

The Overspeed Safety Coupling supplements, and is completely independent of, the regular factory-set weight type governor used in Ingersoll-Rand Air Tools.

This built-in unit, which operates in case of failure of the regular governor, eliminates the possibility of dangerous overspeed operation. If, for any reason, the motor speed exceeds the safe wheel speed, the NEW Overspeed Safety Coupling automatically uncouples the arbor and the wheel from the motor, making it impossible to operate the Grinder until the cause of overspeeding has been corrected.

GRINDER OPERATORS *Also Asked for* THESE *Extra* FEATURES

LONG LIFE ARBOR CONSTRUCTION—Widely spaced, permanently lubricated, precision ball bearings are located at each end of the arbor in a one-piece housing to provide new rigidity and longer Grinder life.

20% MORE POWER—A new, larger, four-vane, swastika-type motor gives 20% more power. Extensive use of light weight alloy castings results in more horsepower per pound. Grinding efficiency goes up and grinding costs come down.

QUIETER EXHAUST—It takes 10 of these new Grinders to produce exhaust noise equal to 1 of the previous machines. The low exhaust noise which is present, is pitched so as not to be irritating.

EXTRA EXHAUST POSITIONS—The operator can choose any one of four exhaust positions, spaced 90 degrees apart.

RUBBER-FACED VALVE—The new composition rubber-faced throttle valve closes properly even if small particles of foreign matter adhere to the valve seat. Replacement is inexpensive, and no lapping is necessary.

OPTIONAL HANDLE—In addition to the popular grip handle, a straight handle with a new safety-throttle lock is available.

Call us today and arrange for a demonstration of this powerful new Series 4 Air Grinder.

Ingersoll-Rand

630-B

11 BROADWAY, NEW YORK 4, N. Y.

A. O. SMITH CORPORATION.—*R. C. Roderick*, formerly head of distribution service at A. O. Smith Corporation's Water Heater division, Kankakee, Ill., has been appointed manager of the Railroad Products division. He succeeds *George B. Peet* who becomes project manager of development programs for the Railroad Products and Welding Products divisions. Mr. Peet functions also as assistant to J. J. Bohmrich, group executive for Railroad Products, Welding Products and Product Service divisions.

◆

YOUNGSTOWN SHEET & TUBE CO.—*Paul B. Baird*, formerly assistant manager of standard pipe sales for the Youngstown Sheet & Tube Co., has been promoted to manager of standard pipe sales, succeeding the late *Glenn W. Christopher*. *Carl T. Selander*, formerly western representative for standard pipe products, succeeds Mr. Baird as assistant manager of standard pipe sales at Chicago.

◆

ALLIS-CHALMERS.—*Chester W. Schweers* has been appointed director of sales of Allis-Chalmers general machinery division at Milwaukee, Wis.

◆

RAILROAD SUPPLY & EQUIPMENT, INC.—*Russell O. Nash*, of St. Louis, has joined Railroad Supply & Equipment, Inc., Scranton, Pa., as sales engineer.

WESTINGHOUSE AIR BRAKE COMPANY.—*E. A. Frauenthal* has been appointed assistant manager of the southwestern district of the Westinghouse Air Brake Company, with headquarters in St. Louis, and *R. M. Beswick* has been appointed assistant manager of the southeastern district, with offices in Washington, D. C.

Mr. Frauenthal has been the company's representative in the southwestern district



E. A. Frauenthal

since 1932, prior to which he was active in the St. Louis office in several capacities since joining the American Brake Company in 1917.

Mr. Beswick has been the Washington representative since 1947. He became associated with the company in 1929. He



R. M. Beswick

served in various capacities in Engineering and Test divisions in Wilmerding, was transferred to New York as service engineer in 1939, and was later appointed assistant to district engineer New York. He was transferred to Washington as representative on January 1, 1947.

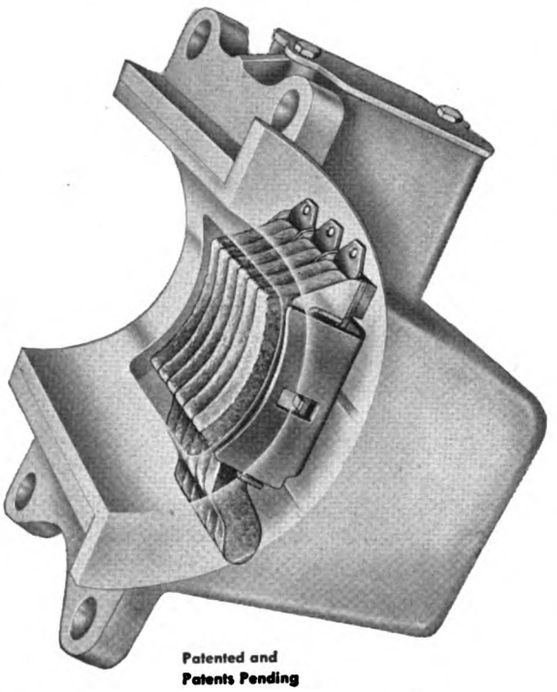
◆

DOW CHEMICAL COMPANY.—A wood preservation laboratory has been established within the biochemical research deparment of the Dow Chemical Company, under direction of *Fred J. Meyer*, assistant by *Ralph M. Gooch*.

◆

ST. LOUIS CAR COMPANY.—Lafayette College, Easton, Pa., has purchased the St. Louis Car Company, of St. Louis, Mo., through acquistion of stock formerly owned by Edwin B. Meissner, Sr., and Edwin B.





Patented and Patents Pending

ELIMINATE *Costly* HAND PACKING...

Convert your Old Fashioned yarn packed caps with... FELPAX *Lubricators*

It's Easy!!!

JUST 3 SIMPLE STEPS

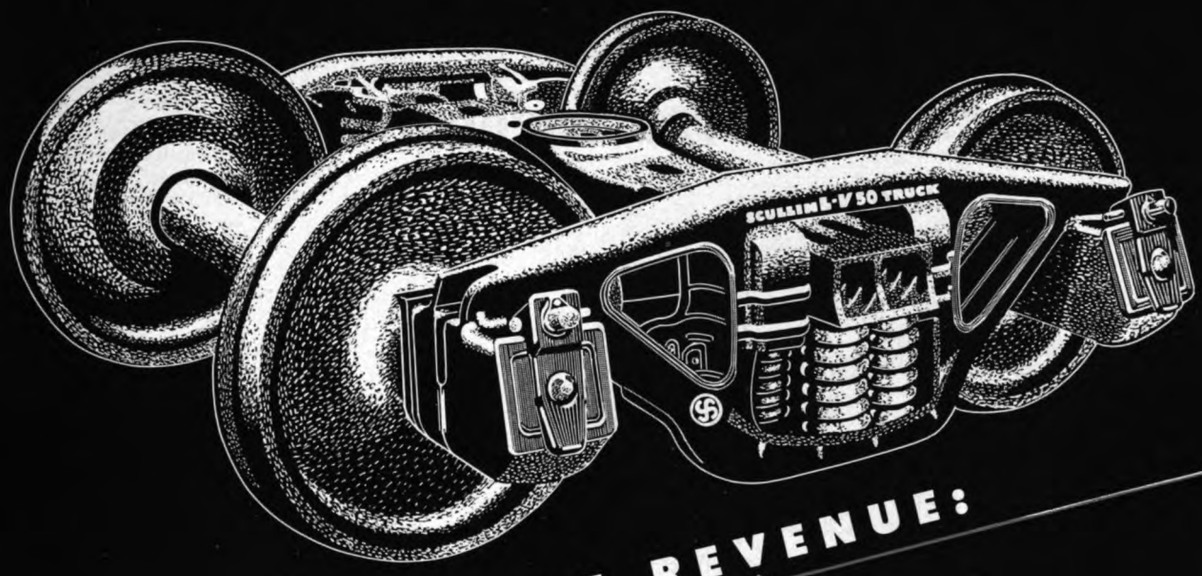
1. Remove yarn pressure plate, (replace with mounting plate when necessary).
2. Fasten factory assembled Felpax carrier into place in axle cap.
3. Insert matched set of wicks.

Modern FELPAX Lubricators require only periodic checking and filling of the oil sump. You can cut maintenance labor to a minimum, eliminate costly waste grabs and starved bearings and reduce wheel change-outs due to excessive thrust wear.
FELPAX Lubricators give tens of thousands of miles of dependable lubrication on diesel traction motor suspension bearings. Lubricators may be completely reconditioned in the field with easy-to-install factory matched wick sets that are available at a nominal cost.

For Full Information about conversion to Modern FELPAX Lubricators see your locomotive builder or write to:



MILLER FELPAX CORPORATION
WINONA, MINNESOTA



Rx FOR MORE REVENUE:

new high speed track PLUS SCULLIN LATERAL VERTICAL L 50 V CUSHIONED MOTION TRUCKS

THE SMOOTHEST TRAFFIC-BUILDERS BETWEEN LCL AND YOUR RAILS



Photo Courtesy Cotton Belt Route

STEEL CASTINGS MANUFACTURER

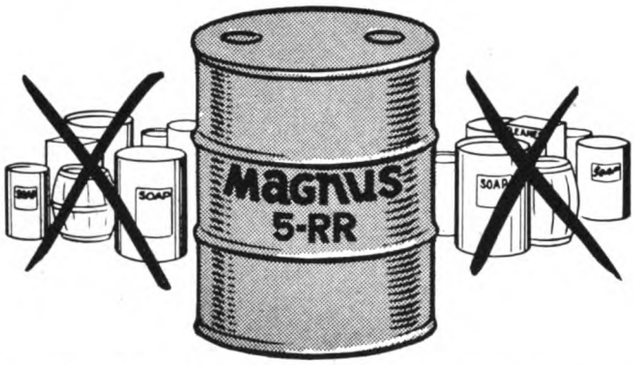
NEW YORK
CHICAGO
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RICHMOND, VA.



SCULLIN STEEL CO.

SAINT LOUIS 10, MISSOURI

ONE CLEANER that *pleases all Departments!*



In these days of specialization, it is a relief to those responsible for cleaning operations in railroads to be able to stock ONE good cleaner for many jobs. Here's what departments say:

Purchasing Agent—*"It's economical . . . reordering is less frequent."*
Store Keeper —*"Eliminates stocking several kinds of cleaning materials."*
Supervisor —*"Cleans faster and more thoroughly and is easy on paint."*
Laborer —*"It doesn't hurt my hands and needs less scrubbing to clean."*
Inspector —*"Equipment has never been so clean as now. Leaves nice gloss."*

MAGNUS 5-RR

is a solvent-soap, developed to dissolve, emulsify and disperse the kinds of dirts encountered in railroad work . . . on exterior as well as interior surfaces. It not only *cleans* . . . it DISINFECTS and DEODORIZES as well. And it is harmless to any good paint or varnish. You can spray it on . . . brush it on . . . sponge it on. It gives bright, clean surfaces in very fast time without a lot of scrubbing. It rinses off quickly, without streaking. It's easy on the hands, too. Use Magnus 5-RR for cleaning . . .

- **Diesel Cabs**
- **Diesel Exteriors**
- **Coach Interiors**
- **Headliners**
- **Washrooms**
- **Toilets**
- **Linoleum and Tile**
- **Station Walls and Woodwork**
- **Station Floors**
- **All Other Painted and Varnished Surfaces**

30-DAY TRIAL OFFER . . .

Order a trial drum of Magnus 5-RR now. If, after 30 days of using this cleaner according to our recommendations, you are not completely satisfied, we'll cancel the full invoice. That's a fair offer we hope you'll accept!

Railroad Division
MAGNUS CHEMICAL COMPANY • **77 South Ave., Garwood, N. J.**
In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT
Representatives in all principal cities

Meissner, Jr., president and executive vice-president, respectively, of the car company. There will be no changes in the company's present organization.

◆

FAIRBANKS, MORSE & CO.—*Charles A. Mapp* has been appointed district manager of locomotive sales in the Chicago area for Fairbanks, Morse & Co., as announced in the July issue of *Railway Mechanical & Electrical Engineer*.

He succeeds *C. H. Morse, Jr.*, who was recently appointed manager of the service department of the company's Locomotive Division.

Mr. Mapp is a graduate of Duke University (1943) with the degree of Bachelor of Science, Mechanical Engineering. In his



C. A. Mapp

first job he worked on the Manhattan Project, Oak Ridge. The next couple of years were spent with the Navy as Lieutenant (j.g.) on a landing craft. He joined Fairbanks, Morse in the Locomotive Service department in 1947, and was later promoted to sales representative, Cleveland area.

◆

THOMAS A. EDISON, INC.—*O. P. Rose*, formerly sales engineer with the Primary Battery division of Thomas A. Edison, Inc.,



O. P. Rose

has been appointed district manager of St. Louis, succeeding *Bedford F. Hines*, who has retired after 34 years of continuous service with the company.

◆

INLAND STEEL COMPANY.—*John F. Smith, Jr.*, general manager of sales of the Inland Steel Company, has been granted a leave

Esso Diesel Fuel

"Tailor-made" to railroad specifications



ESSO DIESEL FUEL has been specifically developed to meet the requirements of railroad diesels. In one of the most exacting tests ever conducted Esso Diesel Fuel was proved on the run through over 300,000 miles of actual railroad operations in a diesel engine. For an economical, dependable diesel fuel specify ESSO.

BACKED BY CONSTANT RESEARCH — keeping pace with latest engine design and developments Esso Railroad Products are constantly being tested and improved.

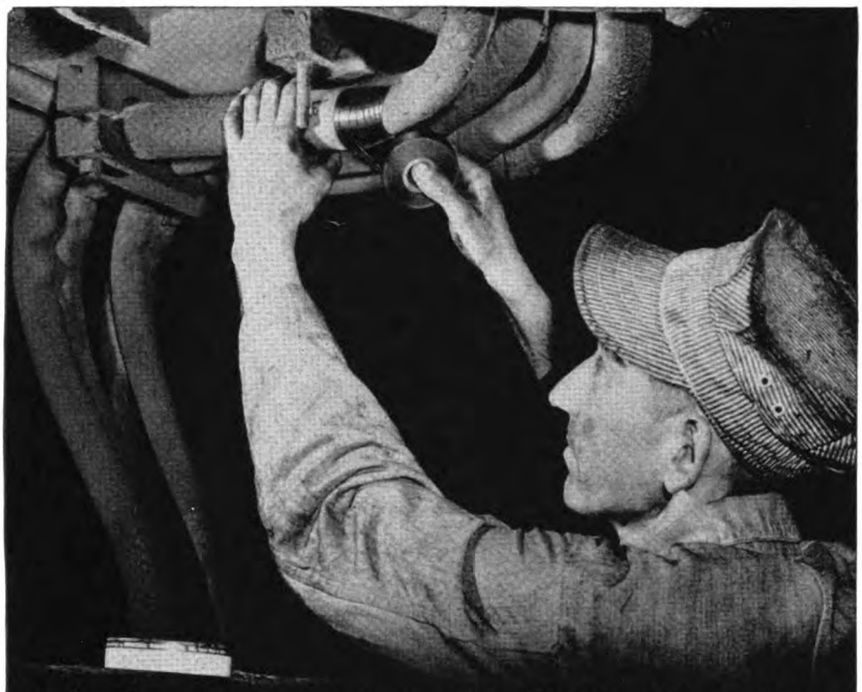
BACKED BY CONSTANT FOLLOW-UP — on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any railroad fuel or lubricating problem.

The Sign of QUALITY — ESSO — *The Symbol of* SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penn., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.



Sealing fibre tubes over motor leads with "SCOTCH" No. 33 Electrical Tape

Plastic tape lasts longer in 90 mph under-car blast!



FLYING ROCKS, cinders and gravel were tearing up under-car wiring insulation until Rock Island engineers discovered "SCOTCH" Electrical Tape No. 33. Now recent checkups show this tough plastic tape gives excellent protection for over 300,000 miles on 90 mile-an-hour streamliners. Plastic backing of tape is unaffected by water, oil, alkalies and most acids.



INTERIOR WIRING gets the same neat, compact insulation with "SCOTCH" No. 33 Electrical Tape. Thin Caliper combined with high dielectric strength makes this tape ideal for installations like these Diesel high-voltage controls. Try it today! Ask for "SCOTCH" No. 33 Electrical Tape. See your wholesaler now!

The term "Scotch" and the plaid design are registered trade-marks for the more than 100 pressure-sensitive adhesive tapes made in U.S.A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minn.—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

REG U.S. PAT. OFF.
SCOTCH BRAND
Electrical Tape
No. 33

of absence for six months to serve as chairman of the production directive committee and as assistant director of the iron and steel division of the National Production Authority, in Washington, D. C.

◆

DOMINION BRAKE SHOE COMPANY.—*Maurice N. Trainer,* formerly president of the Dominion Brake Shoe Company, a subsidiary of the American Brake Shoe Company, has been elected chairman of the board, and *Thomas E. Akers,* formerly vice-president, has been elected president.

Mr. Akers joined American Brake Shoe



Thomas E. Akers

in 1902. He advanced through various sales and supervisory jobs, successively, to vice-president of the Ramapo Ajax division, president of the Canadian Ramapo division, and vice-president of Dominion Brake Shoe.

◆

BRIDGEPORT BRASS COMPANY.—*L. E. Menns* has been appointed Pacific Coast sales manager of the Bridgeport Brass Company. Mr. Menns, who has been serving as Los Aangeles district manager for Bridgeport, will be in charge of the San Francisco district office and warehouse as well, and will be responsible for sales of all Bridgeport products on the Pacific Coast.

◆

AMERICAN LUMBER & TREATING COMPANY.—*Bradley A. Burnside* has joined the sales department of the American Lumber & Treating Co. with headquarters at Chicago, as assistant to *R. B. Putnam,* general sales manager.

◆

GENERAL ELECTRIC COMPANY.—The *Machinery & Welder Corp.,* St. Louis, has been appointed by the General Electric Company as a distributor for G-E stainless-steel arc welding electrodes in addition to the older line of G-E arc-welding equipment and mild-steel electrodes. Stocks of the electrodes will be maintained in warehouses in Chicago, Milwaukee, St. Paul, Moline, Ill., and St. Louis.

◆

TRANSPORTATION SPECIALTIES COMPANY. *Robert B. Borucki,* chief mechanical engineer of the Transportation Specialties Company, has been named to vice-president. Mr. Borucki served as mechanical drafts-

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oil R.R.

UNIT Diesel Locomotive cylinder assembly

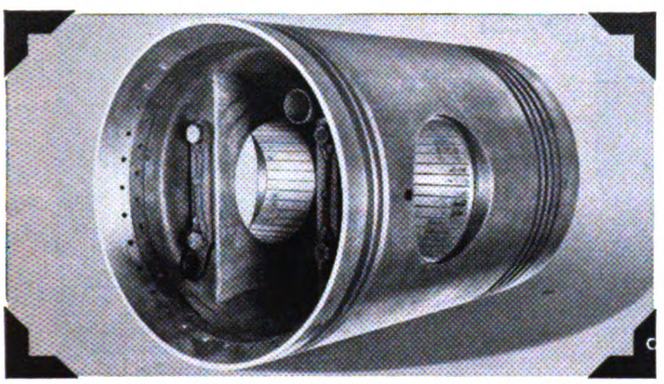
SERVICE Mountain Freight

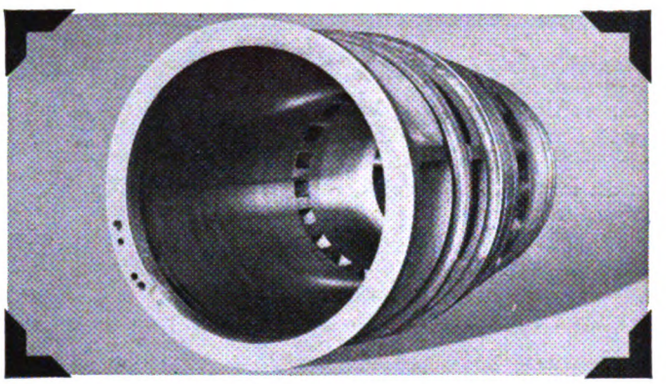
LOCATION Transcontinental freight service on Moffat tunnel + Royal Gorge Routes

PERIOD In excess of 8 years

FIRM Denver + Rio Grande Western R.R.Co.

One million miles of service on cylinder liners and pistons





IN SERVICE APPROXIMATELY 1,000,000 MILES in Denver & Rio Grande Western Railroad diesel locomotive engines, this piston and cylinder liner were always lubricated with RPM DELO Oil R.R. At the end of that time wear measurements (inches) were only: Piston Skirt—0.001; Ring Grooves—No. 1—0.003 to 0.006, No. 2—0.002, No. 3 & 4—none; Cylinder liner (maximum diameter)—0.0095, (out of round)—0.002 to 0.004.

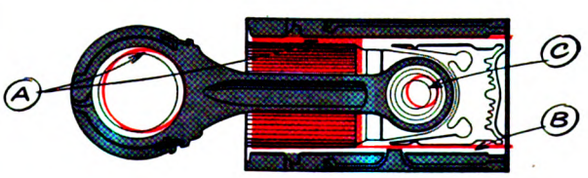


RPM DELO Oil R.R. has been the standard on the Denver & Rio Grande Western Railroad for over-the-road freight and passenger locomotives since their first power of this type was placed in service in January 1942. At the time this inspection was made approximately 49,563,104 miles had been traversed by the Rio Grande freight diesel fleet of 100 units and during that period only 77 cylinder liners had been scrapped for any reason. At that time many of the original pistons and cylinder liners were still in service and the average age of all these assemblies, including recently purchased power, was 4.7 years.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM" REG. U.S. PAT. OFF.

How RPM DELO Oil R. R. prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean... helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushings or bearing metals and foaming in crankcase.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street, San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780, Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862, El Paso, Texas



Take a look at *Strand*

and you'll see why it's the finest flexible-shaft equipment made today



This particular machine is the new 4-speed Strandflex. No belts are used—a patented gear-drive assembly mounted on the motor permits quick, easy, positive speed change. Entire motor-drive unit, including even the starting switch, is completely enclosed to seal out dirt, dust and grit—and give you many *extra* years of trouble-free service.

The STRAND line of flexible-shaft tools – manufactured by the N. A. Strand Division of the Balmar Corporation, a wholly-owned Franklin subsidiary – includes, also, belt machines up to 3 hp. It provides a selection of portable, easily controlled, light-working-weight tools which can be used in tight places, on the bench or floor, for—*grinding—polishing—buffing – wire brushing – rotary filing – sanding—nut setting—screw driving.*

Each of our offices has STRAND equipment available for demonstration at any time you suggest. If this is not practical, won't you write for one or more of the following:

Remember—with STRAND the operator lifts the tool only – not the heavy motor.

Catalogue #31—Single-speed and three-speed countershaft types—⅓ to 3 hp
Bulletin #43 — Four-speed "Strandflex" gear type — ¼ to ½ hp
Bulletin #47 — Rotary files and cutters
Bulletin #48 — Wire brushes
Bulletin #49 — Abrasive and grinding attachments
Bulletin #50 — Buffing and rubbing attachments

REG. U.S. PAT. OFF.

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER POWER REVERSE GEARS • FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS JOURNAL BOXES • FLEXIBLE JOINTS • TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

man, car draftsman and lead car draftsman with the Chicago, Milwaukee, St. Paul & Pacific from 1926 to 1936, and was engineer of passenger car design for the Union Pacific until 1943. Subsequently, he was associated with the Railway division of Reynolds Metals Company as assistant mechanical engineer, mechanical engineer and chief engineer. Mr. Borucki became chief mechanical engineer of Transportation Specialties in April, 1948.

◆

H. K. PORTER COMPANY.—The *Quaker Rubber Corporation*, division of the H. K. Porter Company, has opened a stock-carrying branch warehouse and sales office at 872 W. Milwaukee avenue, Detroit. *J. R. Alexander*, formerly Cleveland district manager, has been appointed district manager of the new branch, which will serve all of Michigan.



L. L. Garber

Lawrence L. Garber, general manager of the *American-Fort Pitt Spring division* of the H. K. Porter Company, has been elected a vice-president of the company.

◆

AMERICAN BRAKE SHOE COMPANY. — *Raymond H. Schaefer* has been elected a vice-president of the American Brake Shoe Company, with headquarters at Mahwah, N. J., as announced in the June issue of *Railway Mechanical & Electrical Engineer.*

Mr. Schaefer joined Brake Shoe in 1940 as assistant foundry metallurgist of the American Manganese steel division, and was later successively foundry metallurgist and general foundry superintendent. In 1943 he was appointed assistant chief metallurgist of the parent company and, in 1945, chief metallurgist. He was appointed director of research and development in 1947. He will continue in charge of the research activities of the company.

◆

MACLEAN-FOGG LOCK NUT COMPANY. —has announced the appointment of *Robert H. Waite*, formerly with the American Car & Foundry Co. in Chicago and New York, has become associated with the MacLean-Fogg Lock Nut sales department in Chicago.

◆

AIR REDUCTION COMPANY.—*S. D. Baumer* has been appointed vice-president of the equipment manufacturing division of the Air Reduction Company. *E. H. Roper*, formerly assistant manager of the general technical sales department of Air Reduction

GOULD



. . . VOLTAGE REGULATOR SETTINGS IMPORTANT

FOR LONGEST BATTERY SERVICE!

Right now, the problem of conserving and extending essential battery power is urgent. Timely help is offered you by the GOULD PLUS-PERFORMANCE PLAN which can improve battery performance as much as 50%! Here is a complete system of manuals, articles, specifications, bulletins, record cards and charts which explains and illustrates how to select, charge and handle, maintain and determine the condition of your car lighting and air conditioning batteries.

The material comprising the GOULD PLUS-PERFORMANCE PLAN is available to battery users without obligation. A request on your letterhead will bring descriptive literature by return mail.





Systematic testing with hydrometer gives accurate check on regulator setting.



Gould "Z" Plate Batteries—America's Finest Car Lighting and Air Conditioning Batteries

HOW TO SET VOLTAGE REGULATOR CORRECTLY

Recommended settings as starting points for various sized car lighting and air conditioning batteries are as follows: 37 volts for 16 cells; 75 volts for 32 cells. Check regulator setting either by specific gravity readings, amount of water added, or both. Excessive water consumption is a sign of too high a voltage regulator setting and setting should be reduced. Dropping off of specific gravity is sign of too low a voltage regulator setting and setting should be raised. It is suggested that settings be changed in steps of ½ volt each. Ideal regulator setting is one that keeps specific gravity at fully charged value with a minimum of water loss.

GOULD STORAGE BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

Sales Company, a division of Air Reduction Company, has been appointed manager of the department.

Mr. Baumer joined the Airco general technical sales department in 1941 as a steel mill specialist and was appointed assistant manager of that department in 1944 and manager in 1948.

◆

JOSEPH T. RYERSON & SON.—*John R. Fennie,* a member of the sales staff of the Los Angeles, Cal., plant of Joseph T. Ryerson & Son since 1946, has been appointed manager of the tubular products department.

◆

AMERICAN HOIST & DERRICK CO.—*Robert J. Stoddard,* chief engineer of the American Hoist & Derrick Co., St. Paul, Minn., since 1947, has been appointed vice-president of engineering.

◆

GEORGIA-PACIFIC PLYWOOD COMPANY.—The Georgia-Pacfic Plywood & Lumber Co. has shortened its name to Georgia-Pacific Plywood Company. The company has opened a new warehouse in Pittsburgh, Pa., at 33rd street and Liberty avenue.

◆

SUNROC REFRIGERATION COMPANY.—*J. G. Crost* has been appointed executive vice-president of the Sunroc Refrigeration Company, Glen Riddle, Pa., for which company he has been acting in a consulting capacity.

GENERAL ELECTRIC COMPANY.—*Raymond C. Freeman* has been appointed manager of General Electric's Welding Divisions at Fitchburg, Mass., and *Alanson U. Welch* succeeds Mr. Freeman as manager of engineering of the Welding Divisions.

PERSONAL MENTION

General



Sidney Withington

SIDNEY WITHINGTON, engineering assistant in the operating department of the NEW YORK, NEW HAVEN & HARTFORD at New Haven, Conn., will retire on August 1, after 41 years of service with that road. Mr. Withington served as chief electrical engineer of the New Haven from June 1946 until December 1948, when he became engineering assistant. He was born at Boston on June 7, 1884, and received his M.E. degree in 1907 from Harvard Engineering School. He entered railroad service in 1910 with the New Haven and served successively as chainman, draftsman, inspector, general foreman, assistant engineer, electrical engineer, chief electrical engineer and engineering assistant. Mr. Withington was chairman (1929-1932) of the Committee on Electricity of the American Railway Engineering Association; chairman (1929-1931) of the Electrical Section and second vice-chairman of Division IV, Engineering, of the Association of American Railroads; chairman (1920-1924) of the Committee on Heavy Electric Traction of the American Electric Railway Association; and chairman (1930) of the Connecticut section of the American Institute of Electrical Engineers.

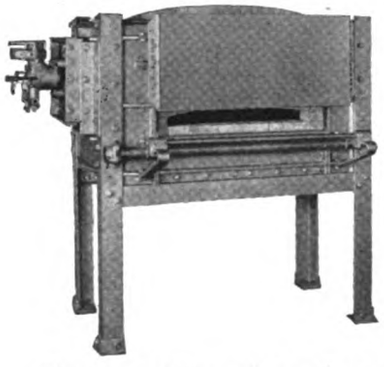
CHESTER K. JAMES, assistant superintendent of motive power of the Erie, has been appointed superintendent of motive power, with headquarters as before at Cleveland. Mr. James was born at Huntington, Ind., on October 16, 1901, and joined the Erie in 1924 following his graduation as mechanical engineer from Cornell University. He served successively, as special apprentice at Meadville, leading machinist, backshop foreman, enginehouse foreman, motor equipment inspector and master mechanic. He was appointed district master mechanic at Meadville in 1944 and assistant superintendent of motive power at Cleveland in 1946.



Chester K. James

WILLIAM G. CARLSON, Eastern district master mechanic of the Erie at Jersey

for QUICK, CLEAN, UNIFORM HEAT at LOW OPERATING COST—



JOHNSTON SLOT-TYPE FORGING FURNACES

★ OIL OR GAS FIRED

★ SINGLE OR MULTIPLE SLOT TYPES

This furnace will maintain uniform neutral or reducing atmosphere for forging and welding which will avoid scale and decarburization. Construction features water, refractory or cast iron shields. Fire brick and insulating refractory brick lining with chrome refractory hearths are new features to reduce maintenance and operating costs and speed production.

★ BURNERS ★ BLOWERS ★ FURNACES ★ RIVET FORGES
★ FIRE LIGHTERS ★ TIRE HEATERS, ETC.

SAFETY THE JOHNSTON LINE DEPENDABILITY

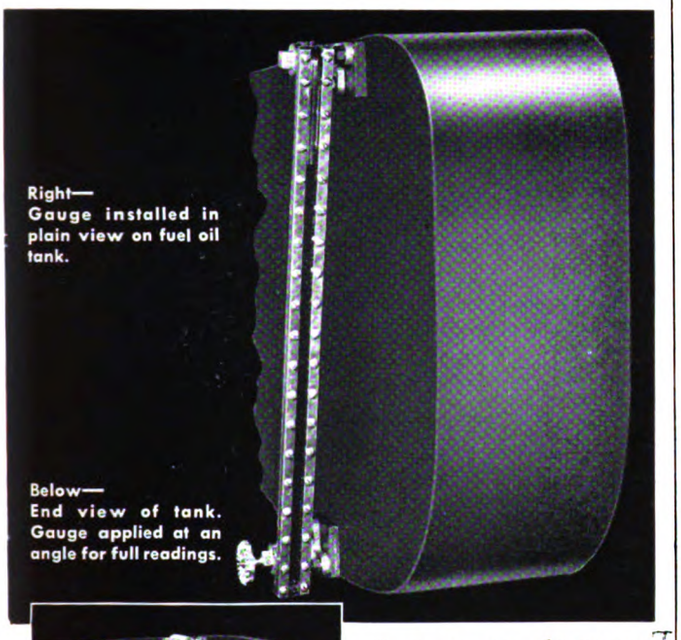
JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

Get Full Readings on Diesel Fuel Tanks

with this New

MAGNUS GAUGE



Right—
Gauge installed in plain view on fuel oil tank.

Below—
End view of tank. Gauge applied at an angle for full readings.



A top-to-bottom gauge, flexible — mountable at any angle, the new Magnus diesel fuel tank gauge gives accurate full readings at all times. With a rigid brass body, the Magnus gauge is substantially built to stay on the job longer . . . not to be disturbed by vibration.

It's easily installed—simply by welding top and bottom plates to tank and drilling two holes. The reflex glass gives you accurate readings at a glance. For quick clean-out, just unscrew top and bottom plugs. Automatic shut-off valve prevents fuel loss in case of breakage.

Write for further information.

MAGNUS BRASS MFG. CO.
Subsidiary of National Lead Co.
525 Reading Road **Cincinnati 2, Ohio**



EX-CELL-O Railroad Pins and Bushings For Diesel or Steam Equipment

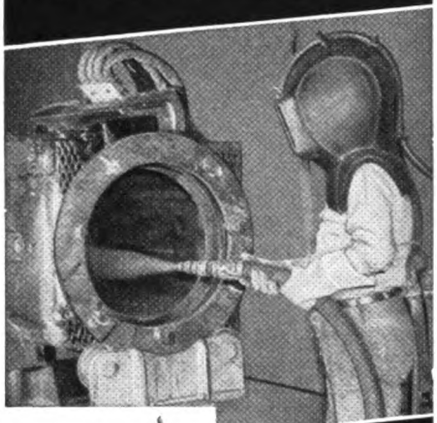
More than 200 railroads and railroad equipment builders (both steam and Diesel) specify Ex-Cell-O pins and bushings. You'll see why when you get this colorful new catalog. Ex-Cell-O railroad pins and bushings are case-hardened for longer wear; finished to precision limits to maintain other parts in alignment and prevent "cocking" of equipment. Steam and Diesel equipment styles and sizes are given in the new Ex-Cell-O Bulletin No. 32381. Write Ex-Cell-O in Detroit for your copy today.

XLO

51-17

Railroad Division
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

CLEAN
Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER

with the right equipment for every job

City, N. J., has been appointed assistant superintendent of motive power at Cleveland. The position of district master mechanic has now been abolished. Mr. Carlson joined the Erie in 1938 as a carpenter helper, following study in mechanical engineering at Purdue University and business administration at Allegheny College. From 1939 to 1943 he worked as an apprentice in the locomotive shops in Meadville and Susquehanna, Pa., when he became a machnist. From 1944 to 1946 Mr. Carlson was in military service. Following return to civilian life, he worked as general foreman of enginehouses at Dayton, Ohio, Buffalo, N. Y., and Hornell. He became master mechanic at Hornell in 1950 and Eastern district master mechanic on May 1.

R. C. TRINKER, general inspector of the New York Central system at New York has been appointed special assistant to manager, equipment, of the New York Central System at New York, with duties to be assigned.

O. L. HOPE, mechanical superintendent of the Southern district of the Missouri Pacific, will transfer his headquarters from St. Louis to Little Rock, Ark.

O. R. PENDY, master mechanic of the New York, Chicago & St. Louis at Conneaut, Ohio, has been appointed chief mechanical officer, with headquarters in Cleveland.

J. A. WETZEL, assistant master mechanic, lines Buffalo and east, at Syracuse, N. Y., has been appointed special assistant to manager, equipment, of the system at New York, with duties to be assigned.

W. R. SUGG, mechanical superintendent of the Western district of the Missouri Pacific, has transferred his headquarters from St. Louis to Kansas City.

JOHN E. KLOSS, supervisor of diesel and motor equipment of the New York, Chicago & St. Louis at Cleveland, has been appointed assistant to chief mechanical

Shop and Enginehouse

H. C. BRADLEY, foreman of the Norfolk & Western at Durham, N. C., has been appointed assistant enginehouse foreman at Shenandoah, Va.

JOHN W. FAVEL has been appointed assistant enginehouse foreman (night) of the Southern at Chattanooga, Tenn.

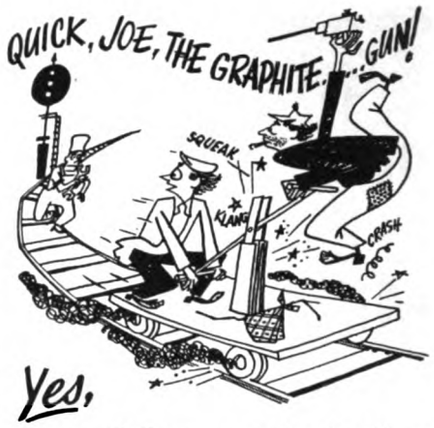
L. F. HAMILTON, assistant foreman in the machine shop of the Norfolk & Western at Roanoke, Va., has retired.

J. G. MOORE has been appointed assistant enginehouse foreman (day) of the Southern at Chattanooga, Tenn.

W. D. MARSTON has been appointed assistant foreman enginehouse (night) AGS, at Birmingham, Ala.

C. W. LEWEY, foreman of the Norfolk & Western at Iaeger, W. Va., has been appointed foreman at Lynchburg, Va.

(Continued on p. 130)



Yes, everything works better with Dixon Graphite!

FOR EXAMPLE:



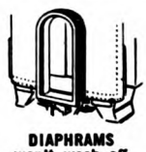
PANTAGRAPHS eliminates friction



SWITCH PLATES no dirt pick-up



CENTER PLATES won't squeeze out



DIAPHRAMS won't wash off



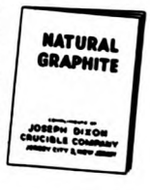
PIPE JOINT COMPOUND stays flexible



ENGINE FRONT FINISH resists heat

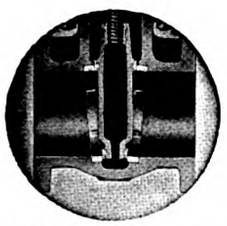
Dixon *Natural* Graphite is unaffected by extremes of temperature —is inert, won't wash off or squeeze out under pressure – doesn't pick up road dirt or dust. For real operating economy use Dixon wherever you have a tough maintenance problem.

SEND FOR FREE SAMPLE of Dixon 1924 – Quick Drying Lubricant. Try it – it's an effective, long lasting dry lubricant, superior to oil and grease for many applications. Also, ask for your copy of technical report "Natural Graphite." Joseph Dixon Crucible Company, Jersey City 3, N. J.

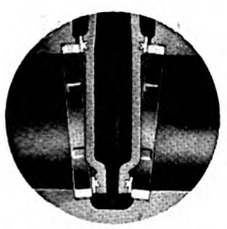


DIXON
NATURAL GRAPHITE

• 1924-Quick Drying Lubricant • Center Plate Lubricant • Graphite Seal • Pipe Joint Compound • Brake Cylinder Lubricant • Engine Front Finish • Bulk Graphite for Compounding • Lathe Center Lube



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.



Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

WALWORTH

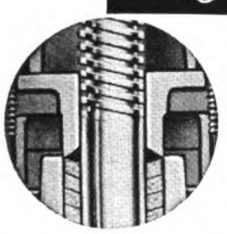
iron body gate valves

with screwed or flanged ends



... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.



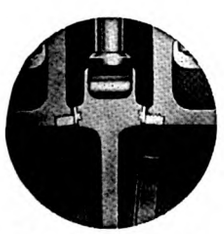
Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

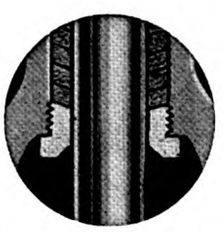
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



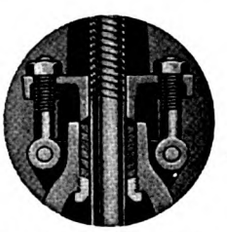
T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



Bronze Back-Seat Bushings in bonnets of OS&Y valves.



Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

Master Mechanics and Road Foremen

RALPH J. HUGHES, assistant to chief mechanical officer of the New York, Chicago & St. Louis at Lakewood, Ohio, has been appointed master mechanic at Conneaut, Ohio.

JOSEPH W. WALSH has been appointed road foreman of engines of the New York Central, with headquarters at Kankakee, Ill.

J. L. BROSSARD, has been appointed assistant master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis Minn.

FRANK N. FOSTER has been appointed assistant road foreman of engines of the Toronto, Hamilton & Buffalo at Hamilton, Ont.

GEORGE E. LUND, Western district master mechanic of the Erie at Meadville, Pa., has been appointed assistant to the superintendent of motive power at Cleveland. The positions of district master mechanic has been abolished.

Obituary

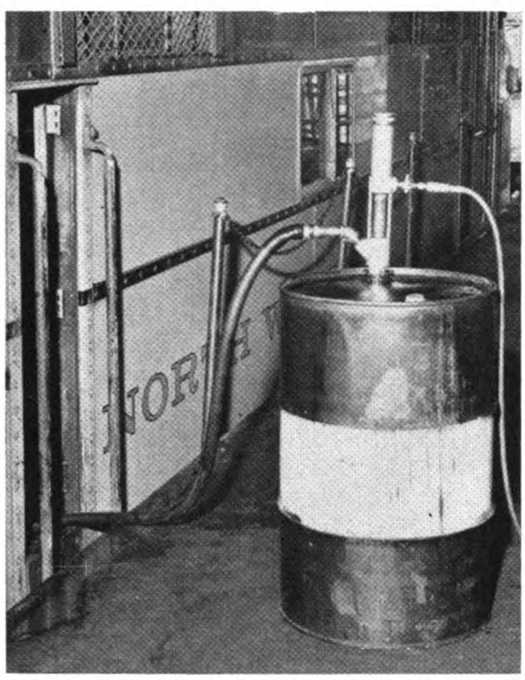
ERIC G. EKLUND, general superintendent and superintendent of motive power of the Rutland at Rutland, Vt., died on June 22. Mr. Eklund was born in Sweden on September 17, 1888, and entered railroad service in 1905 as a machinist apprentice with the Boston & Maine. He subsequently served as machinist on various suothern and western roads until 1911, when he returned to the B&M, as enginehouse and shop foreman. Mr. Eklund became general foreman on the Rutland in 1923. In 1935 he was appointed superintendent motive power and rolling stock and in February of this year became also general superintendent of all operating matters.

THOMAS C. SHORTT, chief mechanical officer of the New York, Chicago & St. Louis, at Cleveland, died at his desk on June 22. Mr. Shortt was born at Crewe, Va., on December 9, 1888, and entered railroad service in April 1906 with the Norfolk & Western at Crewe as apprentice and machinist. He subsequently served with the Atlantic Coast Line, the Norfolk Southern, and the Seaboard Air Line. Mr. Shortt joined the Chesapeake & Ohio in November 1923 as machinist and extra foreman, later serving as enginehouse foreman, erecting shop foreman, chief inspector new equipment and supervisor reclamation. In October 1932 he became equipment inspector of the C.&O., the Nickel Plate and the Pere Marquette at Cleveland. He was appointed assistant to superintendent motive power of the Nickel Plate in July 1933; master mechanic at Conneaut, Ohio, in December 1937; superintendent motive power of the Nickel Plate at Cleveland in June 1942, and chief mechanical officer on May 1, 1943.



Thomas C. Shortt

WILLIAM A. CARLSON, superintendent motive power of the ERIE at Cleveland, died on June 17 while playing golf at the Shaker Country Club. Mr. Carlson was born at Chicago on April 27, 1890, and entered railroad service in June 1906 as a machinist helper with the New York, Chicago & St. Louis at Stony Island, Ill. subsequently serving as machinist apprentice, machinist, enginehouse machinist, assistant enginehouse foreman and general foreman. In May 1928 he became general master mechanic of the Erie at Hornell, N. Y., and in 1929 district master mechanic at Meadville, Pa. He was appointed assistant superintendent motive power at Cleveland on October 1, 1943, and superintendent motive power on January 16, 1946.



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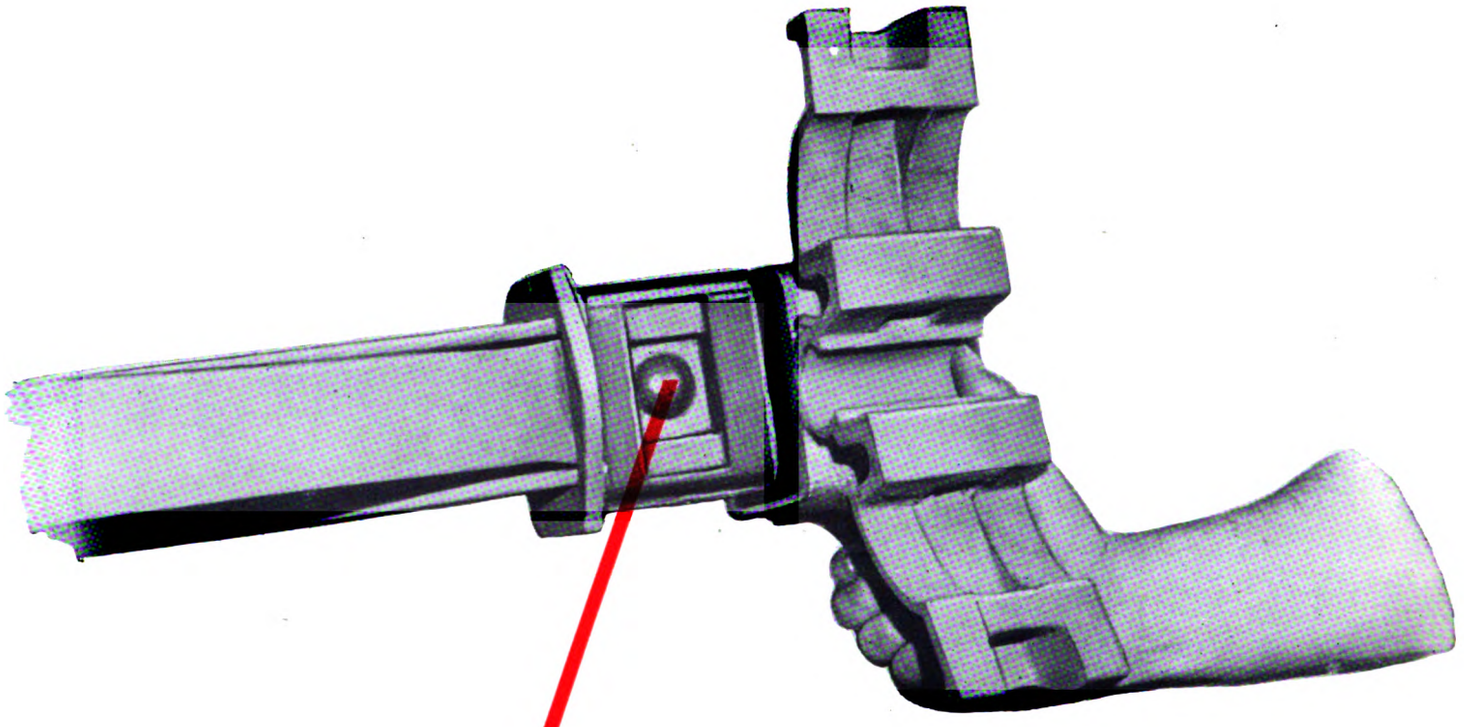
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No. 9

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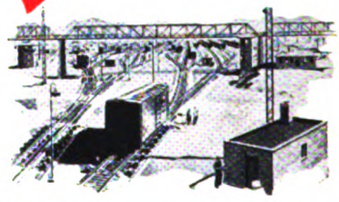
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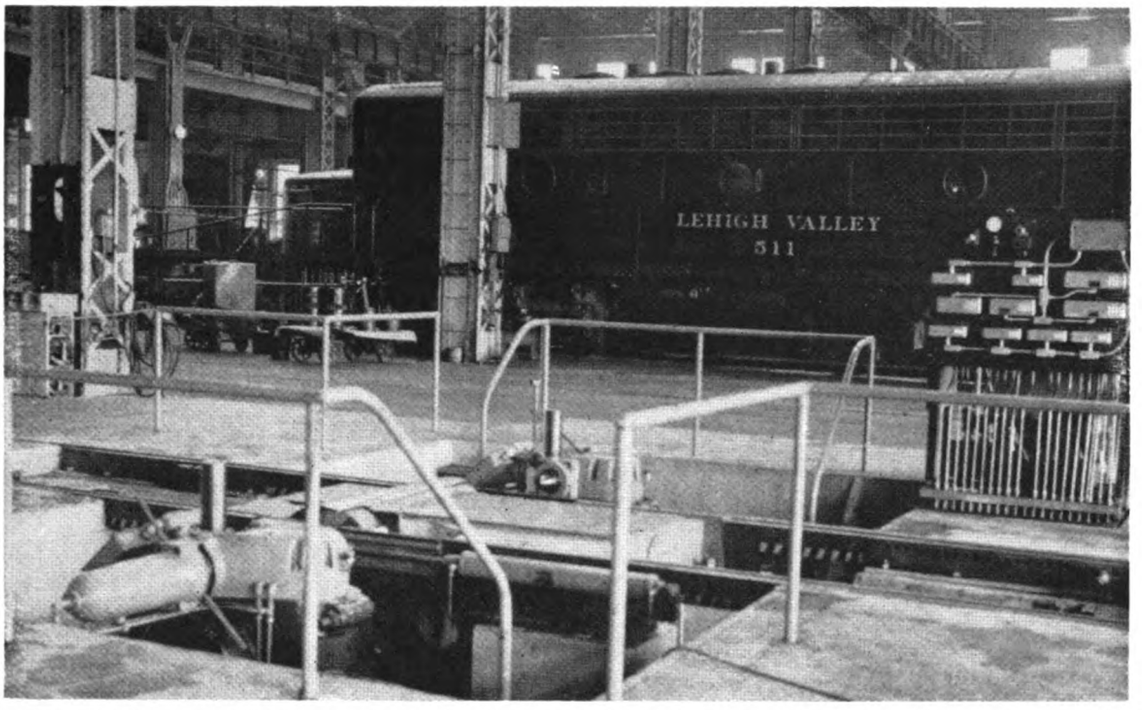
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The Lehigh Valley's diesel wheel-truing machine is located in a pit adjacent to the servicing platforms at Sayre

How the Lehigh Valley Keeps Diesel Wheels in Trim

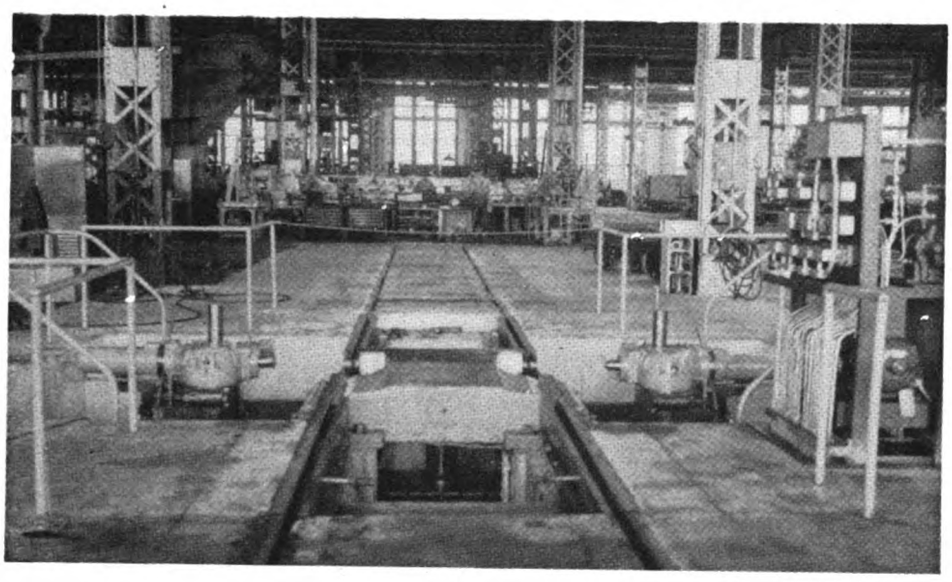
THE Lehigh Valley is turning its diesel locomotive wheels "on the hoof" by use of the wheel-truing machine developed and produced by the Standard Railway Equipment Manufacturing Company. All diesel wheels with defects that require attention, except those that must be removed because they are worn to the condemning limit, are reconditioned during periodic inspections of the locomotives at the road's Sayre, Pa., shops without dropping the wheels or removing the truck. Although the wheel-truing machine has been in service less than three months it is known that substantial direct savings are obtained which will amortize the machine's cost in at least 5 years and probably much earlier. In addition the wheel work does not tie up the diesel units for unscheduled shop repairs or interfere with normal maintenance work, as routine work may be continued while the wheels are being turned. Scheduled operating assignments of the locomotive are not affected.

Direct savings include the man-hours saved in drop-pit time for removing and replacing the wheels and truck and for the removal and assembly of the bearings as well as the man-hours and machine time required to move the wheels to wheel shop and then set up and turn the wheels. The machine also eliminates the additional maintenance frequently needed when truck assembly is disturbed.

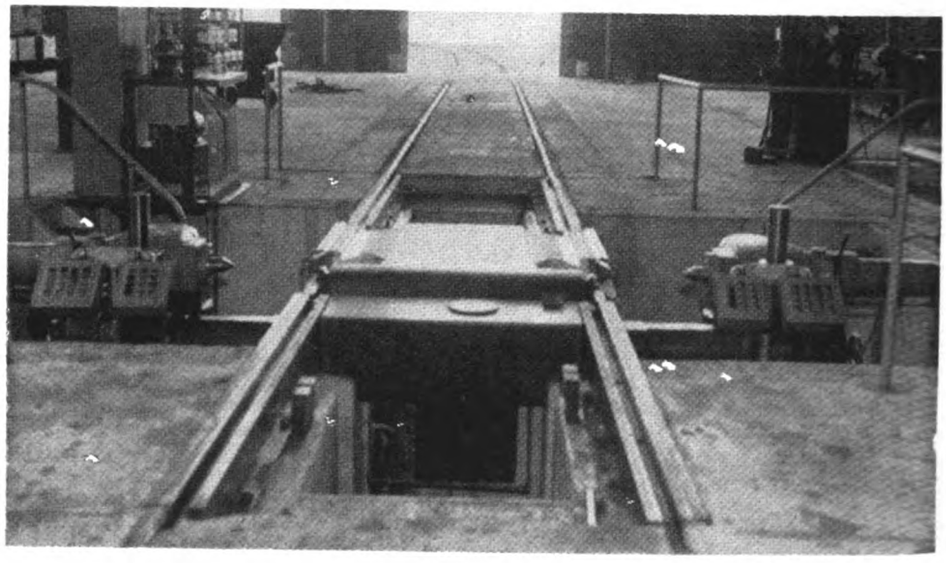
This machine is the second of its kind to be installed; the first one was developed over a three-year period at the Joliet, Ill., shops of the Elgin, Joliet & Eastern. The latter was described on page 464 of the August, 1950, issue. A third is ready for installation on the Southern Pacific at Roseville, Cal., and two have been ordered by an eastern railroad.

The machine at Sayre has a few small but important differences from the "guinea pig" machine at Joliet. A V-type driving roller contacts each wheel flange and turns the pair of wheels during the machining operation, replacing a knurled roller which imprinted objectionable knurl marks on the wheel flange. The cutter has ten instead of eight cutting blades with 11 cylindrical carbide inserts in each, making a total of 110 cutters in the contoured cutter body. The arrangement used to raise the wheels being turned on the drive mechanism and lock the adjacent pair of wheels in the truck has been changed to utilize a simple wedge mechanism.

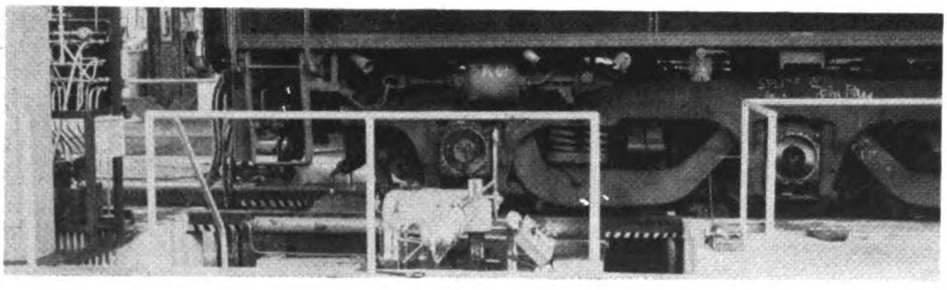
At the Sayre shops a wheel inspection is made of each diesel road unit as it comes in for routine servicing and



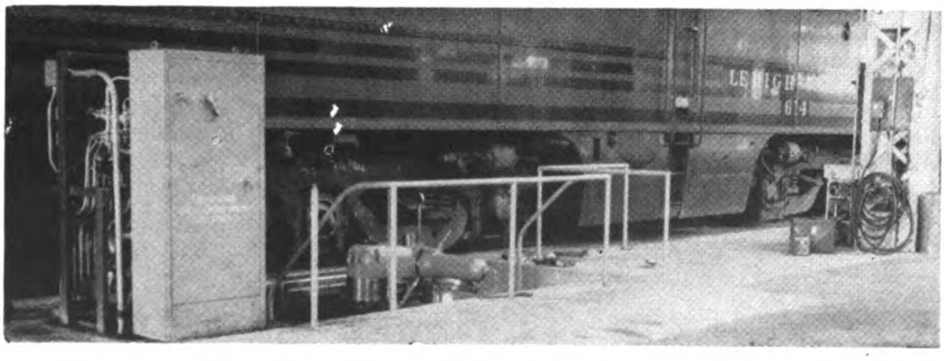
With the rail sections at the machine open, the V shape driving rollers may be seen



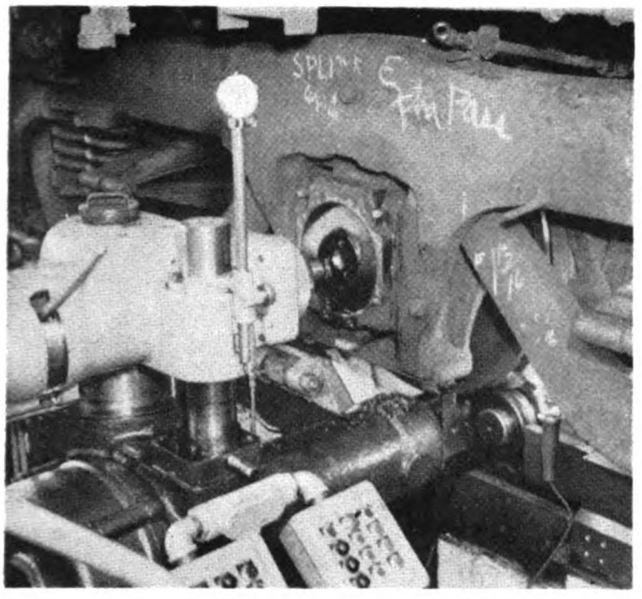
The machine is in a lowered position with the rails in place ready for the spotting of a diesel unit. Duplicate push-button controls are on each side of the track

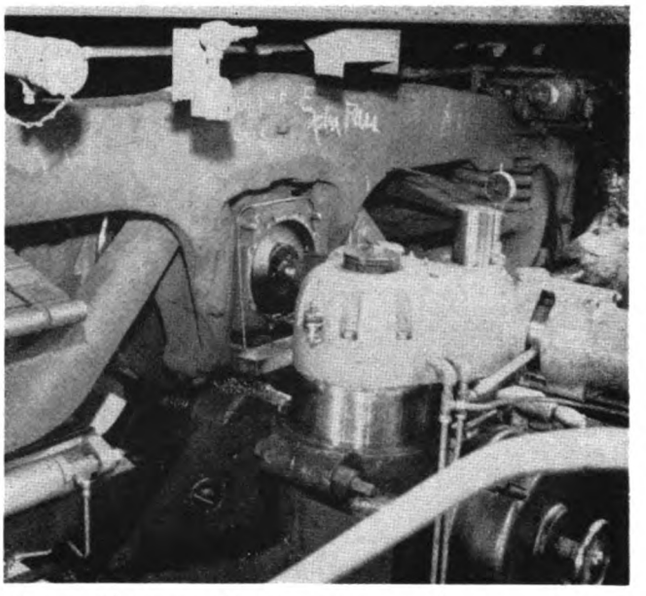


The roller-bearing journal-box covers of the 2,000-hp. diesel passenger unit spotted at the machine have been removed from the two pairs of wheels to be turned. Removal of the covers is the only preparatory operation required



A diesel unit at the machine ready for wheel turning. The machine has not yet been raised to its operating position



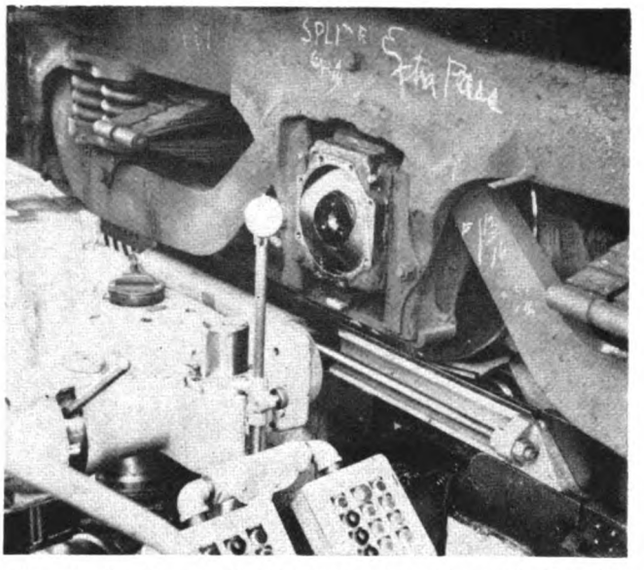


Above: Taking a cut. The contour milling cutter is seen directly under the wheel. Left: The diesel wheel is resting on the driving roller. Wheel centers are out. The dial gage and controls are in the foreground.

maintenance work. Sharp or high wheel flanges, slid flat spots, and other conditions requiring attention on each unit are spotted at this time. As the wheel-truing track is located adjacent to the servicing platforms each unit needing wheel work can be easily shunted over to the wheel machine. In the event that the diesel unit is scheduled for service before the wheels can be turned, and wheel condition permits a delay then the wheels are scheduled for turning at the next regular inspection.

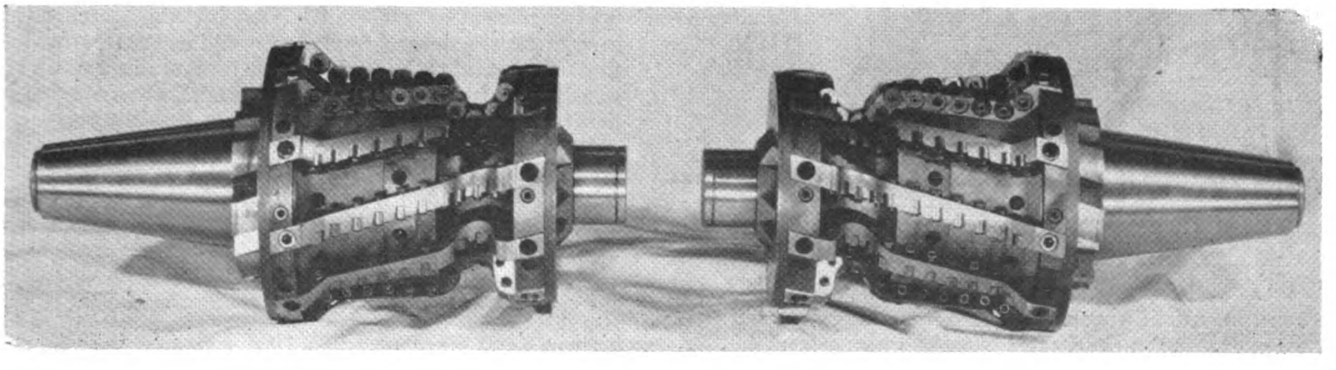
The Lehigh Valley only turns those wheels needing attention. The unit shown in the accompanying illustrations, a 2,000-hp. Alco-G.E. passenger unit, had two pairs of wheels reconditioned at the time the photographs were taken. Each cut taken on the wheel requires 19 minutes of cutting time on a 40-in. wheel. Normally, a ¼-in. or 5/16-in. cut is taken per revolution of the wheels; the number of cuts needed to bring the wheels to the correct contour varies with the wheel condition. Both wheels on each pair are machined to the same dimensions simultaneously as the tailstock centers hold the wheel pair in position and the cutting tools are located to gage. The machine is operated by one machinist and an apprentice, although one man can handle the electrical and hydraulic push-button controls when necessary.

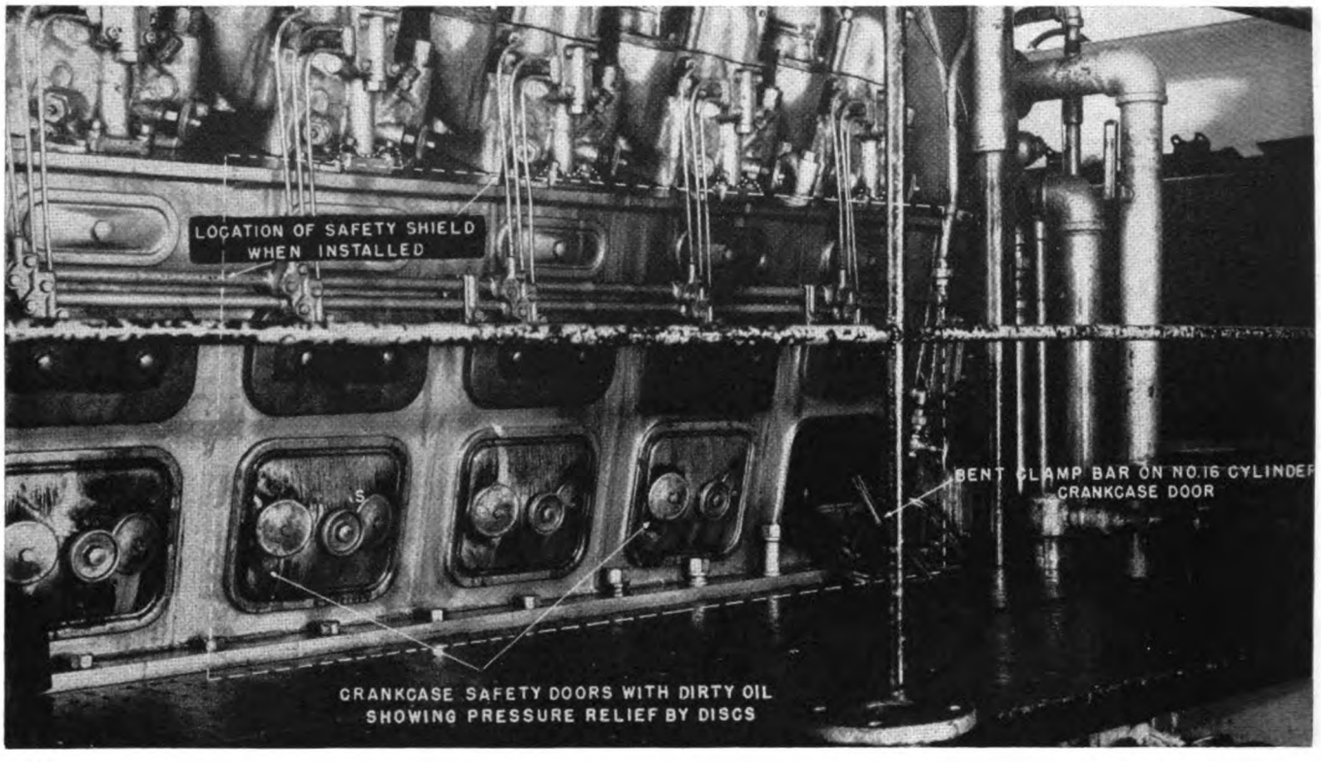
An interesting use of the wheel machine was the removal of flat spots from most of the cars in the Lehigh Valley's "Black Diamond" passenger train after an emergency stop was made to prevent an accident to this train. Although not designed primarily for car work, the cars were back in service within 48 hours.



The wheel-truing machine in lowered position with the rail back in place for movement of the locomotive

The contour cutters have 110 cylindrical carbide inserts that may be rotated as the cutting edges become dull. Each insert is located .0001 laterally from the insert in the adjacent row





Crankcase Explosions and How To Limit the Damage

Damage can be greatly reduced by preventing the second of two rapidly occurring steps which comprise the typical explosion

CRANKCASE explosions occur for the same reason that waste paper ignites when a match is touched to it—a combustible material is raised to its ignition point. Similarly, the ideal way to prevent crankcase explosions is just as simple. Just build, maintain and operate diesel engines so that there never develops any overheating sufficient to reach the ignition temperature of the contents of the crankcase.

This ideal solution is not yet within close reach despite strenuous efforts on the part of diesel builders and maintenance men in the railroad and in other fields where diesel power is employed. A brief review of some of the more serious explosions that have occurred illustrates how varied and complex the factors which contribute to the basic cause are in practice.

In one of the simpler cases to assess, all the top deck covers were blown off and the underside paint of the exhaust manifold shroud blistered for the entire length; the cause was an overheated bearing with no contributing defects. In another explosion caused primarily by an overheated bearing, blow-by from two cylinders was considered a contributing factor.

Dirty lube oil caused a third explosion in two ways. It resulted in frozen rings and a galled piston and liner; sediment in the oil clogged the filter and the consequent low oil pressure resulted in inadequate lubrication. This in turn caused overheating of the engine and the formation of a combustible mixture in the crankcase which was ignited by the products of combustion passing over the frozen rings on the defective piston.

Piston difficulties were the root of trouble in two other explosions. In one, an overheated and broken piston permitted entry of fuel oil vapor into the lower crankcase and interrupted the lube oil supply to the wrist pin and

The illustration at the top of the page shows the results of a crankcase explosion which occurred on an engine at the Naval Experiment Station due to a blower seizure under extraordinary operating conditions during a special test

the associated main bearing. The overheated piston or the bearing then ignited the combustible vapor in the crankcase. In the other case, one piston and its rings were defective, and the compression rings on six of the other pistons were stuck or broken. This condition permitted unburned fuel to blow by and enter the air box, forming an explosive mixture in the air box, which was ignited by the flame blowing by the defective piston.

Add together the direct causes and the almost infinite number of possible combinations of circumstances that can lead to crankcase explosions and it can be seen that their complete elimination is not easy, nor is it likely in the foreseeable future. The most desirable alternate solution to the problem is, therefore, to keep to a minimum the damage that results from those explosions that do occur.

Minimization of this damage appears most likely to be attained through mechanical design. Little or nothing can be done from a lubricating oil or fuel oil standpoint to prevent crankcase explosions so long as inflammable lubricants are employed.

Two papers presented at the June meeting of the Oil and Gas Power Division of the A.S.M.E. dealt with the causes of crankcase explosions and how to limit the resulting damage, and information contained in both of these papers is included in this article. One paper was by A. C. Cavileer, head of the large diesel engines branch of the U.S. Navy Internal Combustion Engine Laboratory of the engineering experimental station at Annapolis, Md. The second was by G. W. Ferguson of the Texas Company.

Explosion Is in Two Phases

Both papers agreed that the problem of minimizing the damage from crankcase explosions boils down to preventing what technical experts in the diesel field refer to as the *secondary* explosion. This is the explosion that automatically and quickly follows the initial, or *primary*, explosion. It is not related to any second explosion that might take place as a result of starting too soon an engine that has been shut down because of one explosion having occurred.

Why the secondary explosion is responsible for most of the damage to equipment and most of the injuries to personnel in the overwhelming majority of cases, and why this secondary explosion occurs, can be seen by tracing the steps involved in a typical crankcase explosion.

First of all, a source of heat above the minimum ignition temperature of the contents of the crankcase must be present in the crankcase. In the great majority of explosions, this heat is furnished from an overheated part, such as a seized piston or an overheated bearing, although there are other possible sources that have been reported, such as "flame-torching" through lined-up cylinder ring gaps.

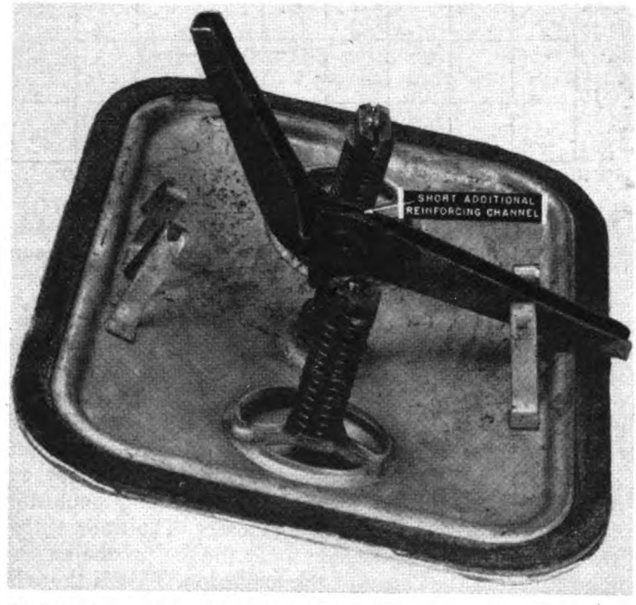
This source of heat ignites the mixture of oil mist and air in the crankcase, causing the *primary* explosion. This may occur with or without any outward signs of trouble. In many cases operating personnel are forewarned of the approaching danger by large clouds of white smoke issuing from around the crankcase doors or by excessive engine vibration and noise.

The mixture which is ignited comprises air plus mechanically atomized oil droplets and perhaps vaporized petroleum products produced by the lube oil coming in contact with the overheated parts. Depending upon the air-fuel ratio, the ignition source, the shape and size of the enclosure, and other factors, a primary explosion occurs. This varies in intensity from a puff of white smoke to a severe explosion. Usually, all the factors do not occur just right to produce the more violent explosion.

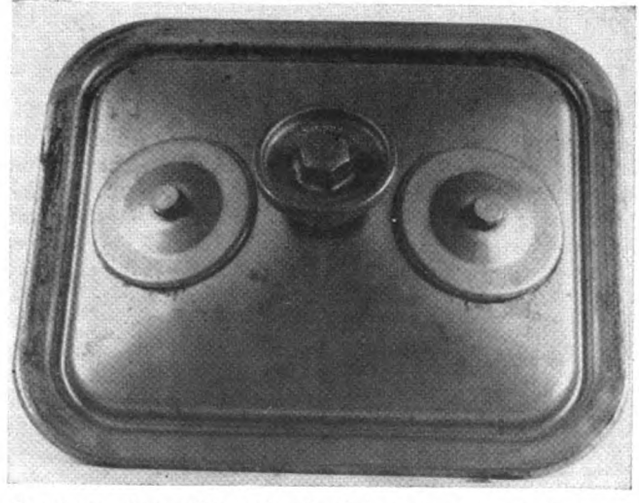
If, at this point in the cycle, in the case of the more violent primary explosions, the crankcase can be vented to the atmosphere through adequate openings, excessive pressure will not build up in the crankcase. However, when the expansion and escape of the gases due to the pressure and energy of the explosion are finished, the gas in the crankcase contracts and pulls a fresh supply of air into the crankcase. This inrush of air can furnish the necessary oxygen for the secondary explosion.

If the engine is equipped with relief openings which close immediately after the primary explosion, the engine can possibly be stopped in time to prevent any following explosions. Gasket or frangible-diaphram-type release valves, however, provide only for the relief of the primary explosion, and do not prevent the inrush of the fresh air. Fresh air is likewise free to rush in when relief of the primary explosion is by a crankcase door blowing off or by some part of the crankcase rupturing.

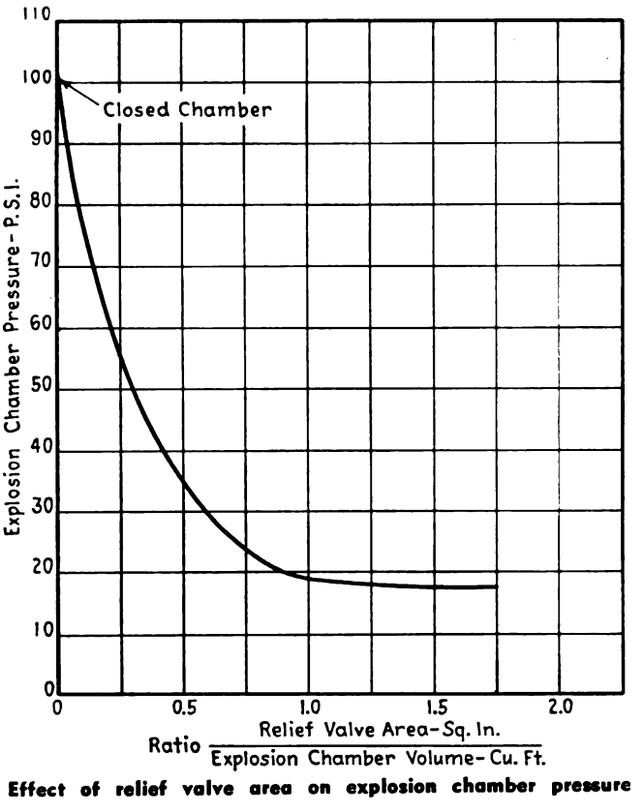
The greater severity of the secondary explosion can be



Failed clamp bar of a door blown off the navy test tank during a test in which the maximum explosion pressure seldom exceeded 16 p.s.i.



Crankcase door with spring-loaded plates to relieve excess pressure gave good results



Effect of relief valve area on explosion chamber pressure

explained by the change in the richness of the oil mist and air mixture. The primary explosion occurs in a relatively rich and slow-burning oil-air mixture. The inrush of fresh air caused by the cooling of the primary explosion gases provides sufficient oxygen to form a leaner and more explosive mixture for the secondary explosion.

An interesting phenomenon following the primary explosion and tending to prevent the secondary explosion has bee observed in a number of cases. The door which was blown off the crankcase was at the end of the engine opposite from the cause of the explosion. This is thought to be the result of the pressure in the crankcase increasing as the pressure wave progresses along the length of the crankcase. The secondary explosion did not occur because, as the gases contracted, the burned, oxygen-depleted atmosphere receded toward the closed end and thus prevented fresh oxygen reaching the hot spot.

How To Limit the Damage

The U.S. Navy has underway a series of tests for the purpose of learning how best to be able to contain the explosions that do occur and to limit as much as possible the effects of crankcase explosions and the fires which sometimes follow. The program includes the testing and development of adequate crankcase covers for all types of engines commonly used in the Naval service that are known to be subject to crankcase explosions. It includes also tests on two-cycle engine air box covers as this problem is similar. The tests were divided into two categories:

1. Test of explosion relief type doors designed to relieve the initial explosion pressure and thereafter to seal the crankcase from the inrush of fresh air which follows the explosion.

2. Test of plain type doors to withstand the pressures of the crankcase while other relief means are operating to prevent excessive pressure rise in the crankcase.

Results of the test showed that several otherwise satisfactory crankcase door installations were ineffective in providing protection against explosions. The most serious deficiencies were the method of securing the door to the engine, and the method and material used for the gasketing between the door and the door opening.

The set up for the test comprised an explosion chamber equipped with the crankcase door to be tested. Because the gas composition that exists in a crankcase was impossible to reproduce exactly, a mixture of chemically pure propane and air was used. Propane was selected because it has the highest rate of flame propagation of all the paraffinic hydrocarbons and should give as high or higher an explosion pressure than would be encountered during a typical crankcase explosion. The necessary measurements and steps were taken to insure a correct mixture of the propane and air in each test. A Maihak diesel engine cylinder pressure recorder with the drum driven by a belt from a motor was used to record combustion pressure. Ignition of the charge in the tank was by spark plug, and high-speed movies were taken of the test.

The first test on several makes of doors dramatically disclosed what could happen when a severe crankcase explosion occurs.

Due to the weak construction, the strongback would buckle and collapse, and the door would fly violently from the test tank followed by considerable flaming gas and slam into the sand bag rebuttment. Concussion from the explosion was severe; in one case nine panes of window glass were broken. No one would be safe anywhere in the vicinity of the engine where he could be struck by one of the doors or close enough to be burned by the flames which followed.

Surprisingly enough, the explosion measure recorded during an explosion when a door was blown off seldom exceeded 16 p.s.i., giving a total force on the door of approximately 1,800 lb.

What Relief-Type Doors Can Do

Several styles of relief type doors were developed and tested, and the results on two types were the most significant. The first type of door had spring-loaded plates to relieve the excess pressure.

The results on this type door were quite satisfactory. When an explosion occurred, the relief plates opened and permitted the gradual escape of the explosion gases and prevented a build-up of excessive pressure. No violence or concussion accompanied the explosion, the only sign of which was a moderate sound similar to escaping air pressure. The recorded pressure was approximately 20 p.s.i.

It was found desirable to provide retainer rings for flame protection and to use good cementing technique for the cork gaskets on the plate because of the tendency of the explosion to blow the gasket from the plate or to burn the edge and face of the gasket.

A graph was plotted to show the explosion chamber pressure for different ratios of relief-valve area to crankcase volume. From this it was concluded that it is desirable to have approximately 1.5 sq. in. of relief valve area for each cubic foot of crankcase volume.

The second door tested provided maximum gas escape area by being held onto the engine frame with a spring loaded strongback. Explosion pressure was relieved by lifting the entire door off the opening.

Results of this test were disappointing because, despite adequate relief of pressure and ability to reseat prop-

erly, the door was awkward to handle, too heavy, and when it did relieve an explosion, the concussion was severe. The flame present when the door lifted was greater for the same explosion condition than with the small relief plates. Explosion pressure in the tank was approximately 15 p.s.i. with this door.

Reports of crankcase explosions which have occurred since the application of the improved type doors indicate that the explosions have been contained, and dangers to personnel and equipment greatly reduced.

Additional Basic Factors

The investigation by the Texas Company into the subject of crankcase explosions differed somewhat in scope from that of the Navy in that the Texaco tests were aimed more at determining the basic causes of crankcase explosions and the basic factors affecting their severity.

One of the most interesting, and perhaps startling, conclusions reached in these tests concerned fuel oil dilution. No significant differences were found in the minimum ignition temperature of a wide variety of lubricating oils, *even when diluted with up to 20 per cent diesel fuel.*

The Texaco study also found that the crankcase atmosphere of a normally operating diesel engine is not composed of explosive gases or an appreciable amount of oil vapor, but of a potentially inflammable mixture of air charged with particles of oil sprayed and thrown from the engine's moving parts. With commonly used lube oils only negligible quantities of oil vapor are present until flame or an overheated part vaporizes sufficient quantities of oil particles to form, locally, an inflammable mixture of oil vapor and air.

Vaporization of the crankcase oil by an overheated part and its subsequent condensation can contribute substantially to the formation of an inflammable mixture when the engine is shut down. White smoke is thought to result from the vaporization of the oil mist by a hot surface, and the subsequent condensation to form a finely divided oil mist.

Experimental work by Haber and Wolff, two European scientists, showed that the lower limit of inflammability of the condensed mists of oils is essentially the same as for the oil in the form of a vapor, but that the flame speed was less in the mists and decreased with increasing particle size. It was also indicated that the lower limit of inflammability of lubricating oil mist compared closely with diesel fuel and other lower flash point hydrocarbons.

Tests conducted by the U.S. Bureau of Mines indicate that decreasing the oxygen concentration of a mixture of air and oil mist will narrow the inflammability limits until a minimum oxygen concentration (about 12 per cent) is reached below which flame will no longer propagate.

Certain changes in the crankcase atmosphere occur during primary and secondary explosions. Partial combustion of the oil vapor in the vicinity of a hot spot increases the fuel concentration and decreases the oxygen concentration because of the vaporization and partial combustion of the oil vapor in the vicinity of the hot spot. If sufficient energy is transferred from the hot part to the air-oil mixture before the oxygen concentration is reduced below the minimum for flame propagation, a primary explosion may occur. If this does not rupture the crankcase, and no additional air is supplied, the further reduction in oxygen concentration and the increase in oil vapor will render the mixture non-explosive.

If there is a sufficient time lag before enough energy is transferred from the hot part to the oil-air mixture, the oxygen concentration is reduced below the propagation minimum because of the partial combustion of the oil vapor in the vicinity of the hot spot. This is attested by the many instances where overheated parts have not caused crankcase explosions.

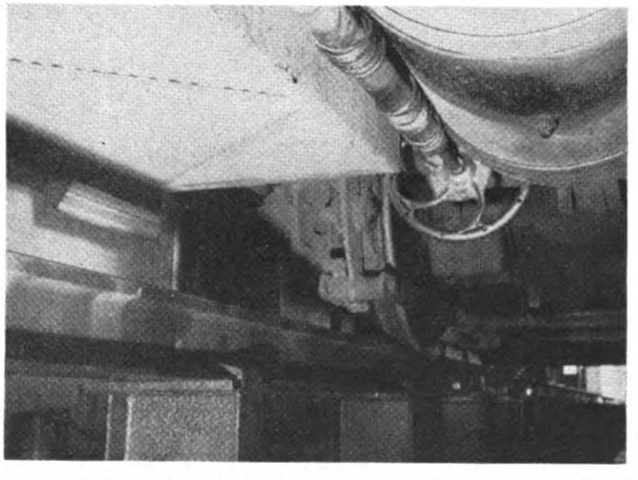
The extreme heterogenity of the mixture in the crankcase undoubtedly makes ignition a very complicated process. With an ignitor surface heated to 1,400-1,500 deg. F., in an air-oil mixture simulating that in a diesel crankcase, there is an appreciable delay before general ignition occurs. This delay is about the same for mixtures with large droplets as for those with a finely divided oil mist, but combustion is more complete with the finer mist. The minimum ignition temperature is from 1,400 to 1,500 deg. F., except for very lean mixtures where the minimum ignition temperature increases rapidly.

Over a wide range of oil-to-air ratios, the minimum ignition temperature is lowered by decreasing the air flow, and by increasing the mixture temperature and the ignitor size. As conditions for transferring heat from the point of ignition become less favorable, the mixture will ignite at a lower ignitor temperature. Therefore, improving the transfer of heat from the point of ignition will reduce the tendency for an explosion to occur.

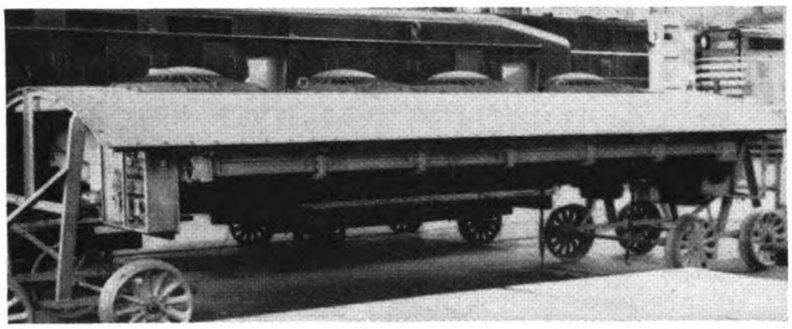
Simplifying Air Reservoir Removal

To remove air reservoirs from diesel locomotives for annual inspection, and to reapply them following inspection, the Great Western shops at Oelwein, Iowa, employs a portable lifter. The lifter consists of a long shaft, turned by a wheel at one end, around which are wrapped two long steel cables.

The shaft has two hooks which fasten to brackets on one side of the drum, and there are two hooks on the ends of the cables which fasten to the brackets on the other side. To remove a drum the wheel is first turned so as to raise the drum, which takes the weight off the bolts for removal. When the bolts have been removed, the wheel is turned in the opposite direction to lower the reservoir. The reverse procedure is employed for applying the drum.



Device for lowering air reservoirs preparatory to making annual inspection and for reapplying them upon completion of inspection. The view is looking upward from the pit

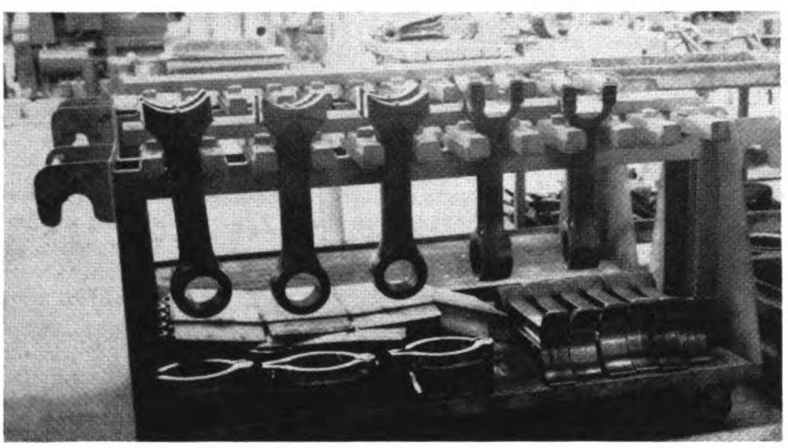


< A stand for holding locomotive hatch built of welded channel and angle-iron sections. It is mounted on maintenance-of-way car wheels and can be moved outdoors when the shop is crowded, if weather permits

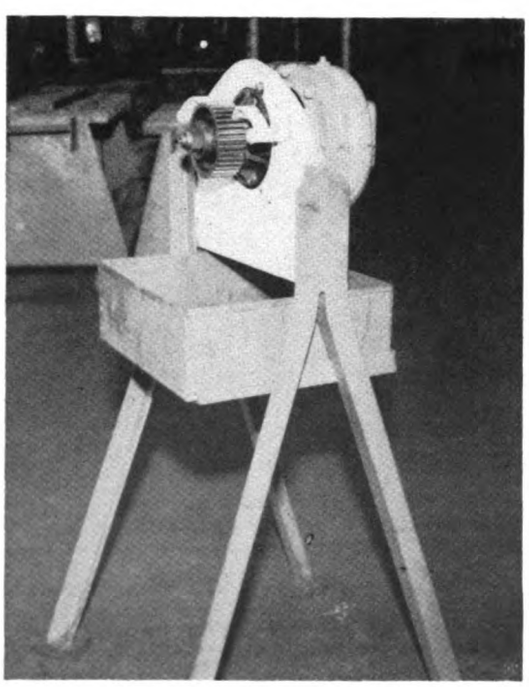
Car and Locomotive Ideas from the Chicago & Eastern Illinois

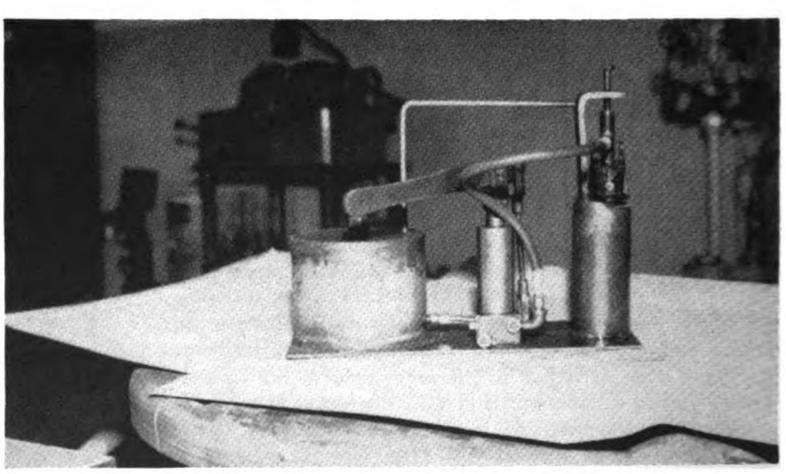


A The cutting fluid for honing operations at the Danville, Ill., shops (diesel fuel oil rather than kerosene in this case) is distributed by an air-circulating pump removed from a lathe no longer in service



< A cart for hauling various rod assembly parts has end members with a pin welded in place between the sides to permit easy handling by crane

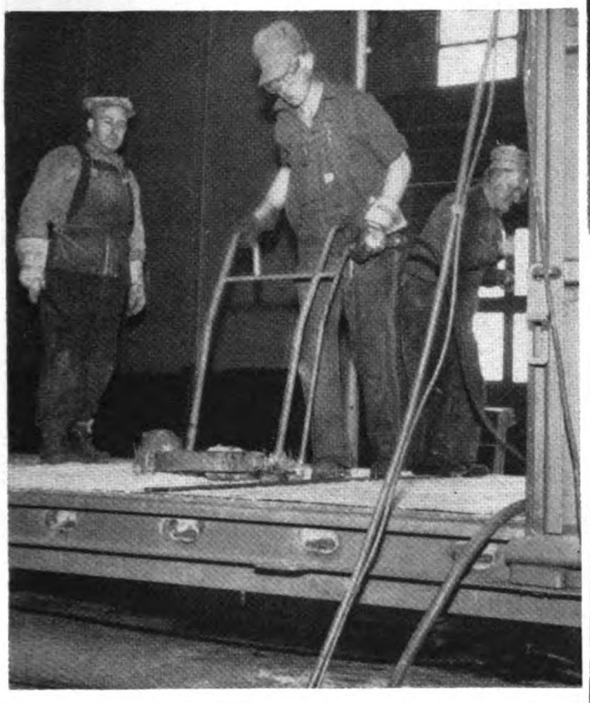


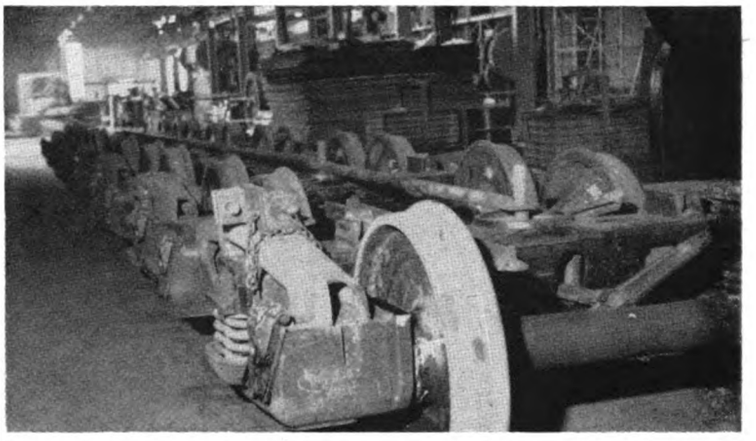


A Lash adjustor loader fills hydraulic lifters with a single stroke of the pump handle, avoiding the tedious job of pumping up the pressure by thumb

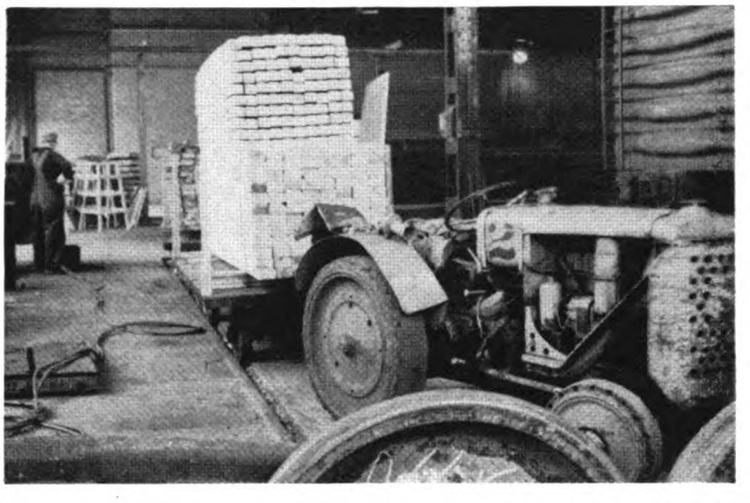
< Pump stand used in the diesel shop. The pump bolts to the main (white) section of the stand for assembling or disassembling. The two locks engage the gear teeth, one to keep the shaft from turning while removing the nut, the other while applying the nut

For application of threshold plates floors are grooved with an air grinder fitted with a da-do head and mounted on a carriage. The grinder is guided by two small wheels on the operator's left which run in a channel iron strip nailed to the floor



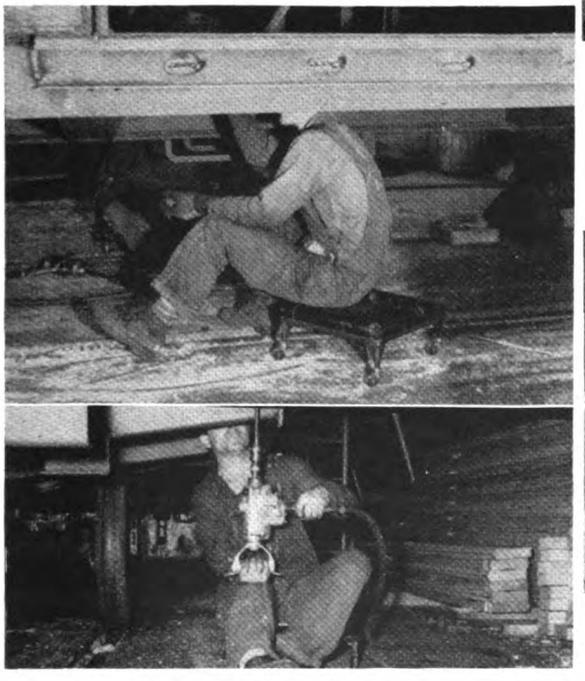


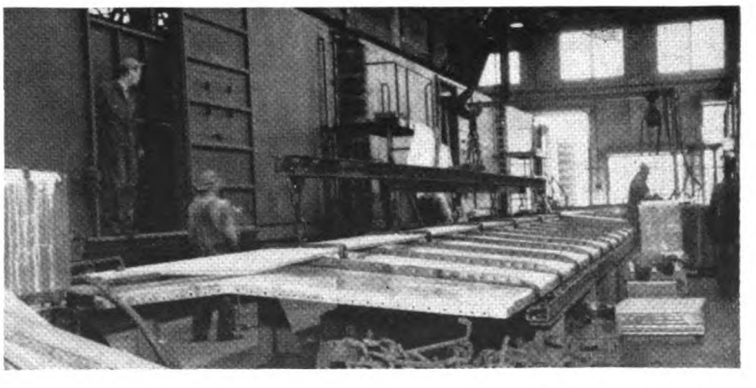
Any number of trucks can be moved at one time by a switcher when coupling rods are used. Each rod has two flared ends which fit over the body center pins of adjacent trucks. Connection with the switcher is made by the dummy coupler resting on the left side frame of the truck in the foreground. A 7/8-in. bolt on the coupler drops through a channel-shape member which fits around the knuckle



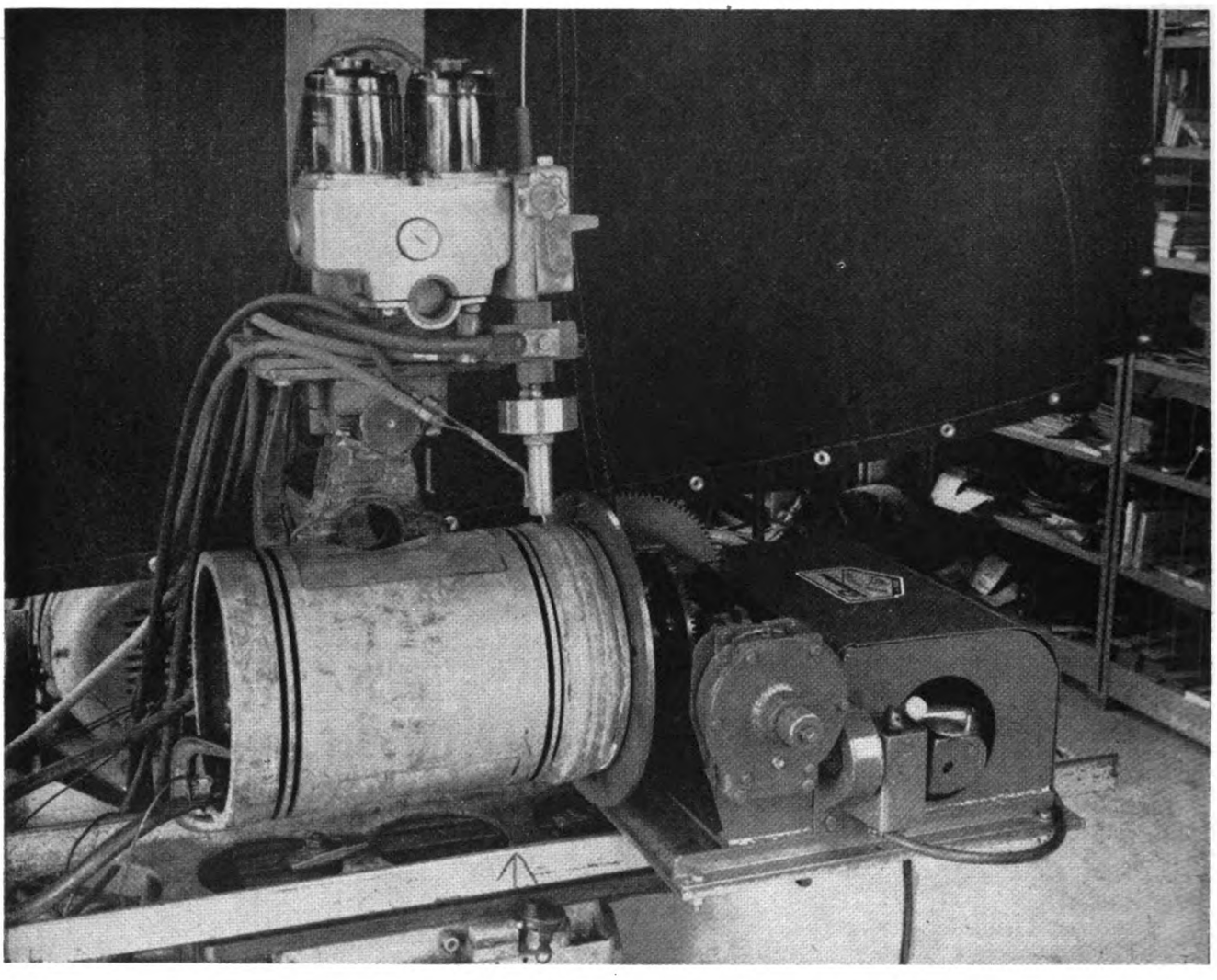
Lumber prepared in the carpenter shop for the box-car building program at Danville, Ill., is strapped together in convenient size bundles for movement to the assembly shop

Floor chairs mounted on four casters are used by the C. & E. I. for drilling, reaming, applying floor bolt nuts and other underneath work on freight cars





Roof lifter used at Danville comprises an I-beam with clamps that drop over the running board and are secured by drop-end pins



Reclaiming Aluminum Diesel Locomotive Parts*

By La Motte Grover†
and R. L. Rex‡

THERE is an increased trend toward modifying the ordinary type of organization for railroad mechanical departments to include a centralized special diesel locomotive reclamation department under the supervision of a diesel reclamation foreman with carefully picked and specially trained personnel and with special equipment, including initial and final testing equipment; also with facilities for packaging for storage and facilities for shipment for reuse. Railroads that have adopted such an organization for diesel locomotive reclamation work have found that it has greatly increased their efficiency.

Fig. 1 (above)—Set-up for building up the worn ring-groove area of an aluminum piston by the automatic inert-gas-shielded metal-arc welding process employing a continuously fed filler-wire electrode

*Part 1 of an abstract of a paper presented before American Welding Society.
†Welding Engineer, Air Reduction Company.
‡R. L. Rex, superintendent of railroad service, Air Reduction Company.

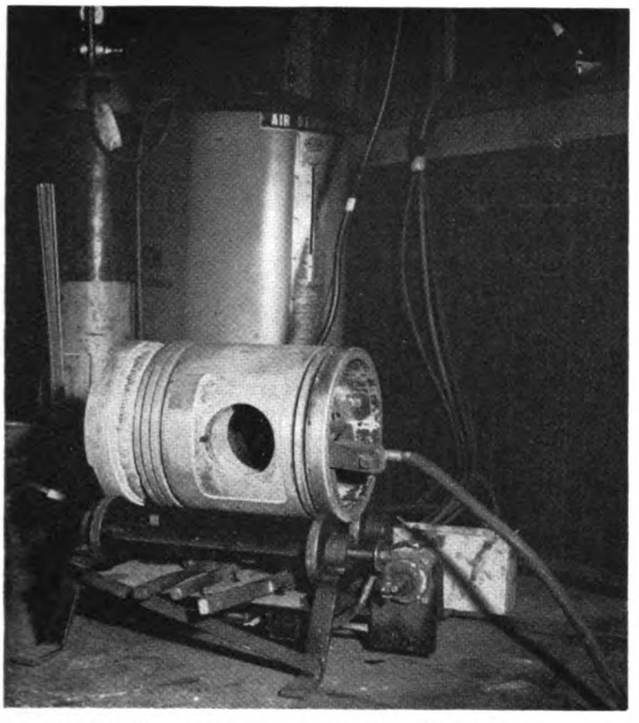


Fig. 2—Aluminum piston on positioning rolls where ring-groove area is being built up by the manual tungsten-arc process of inert-gas-shielded welding

One of the best examples of continued development and refinement is in the reclaiming of aluminum pistons. The earlier practices of using oxyacetylene welding and conventional arc welding with aluminum stick electrodes have been replaced largely by inert-gas-shielded arc welding to save time and cost, and to provide higher quality weld metal than that deposited with aluminum stick electrodes. The tungsten-electrode inert-gas-shielded process, with the filler metal fed separately into the arc, Fig. 2, has come into general use where the volume of aluminum pistons to be reclaimed is not large enough to warrant the cost of the more elaborate equipment having a continuously fed filler-wire electrode, Fig. 1. However, the operating costs are considerably lower for the latter.

The most commonly occurring defects to be repaired are cracks or heat checks in the middle of the head of the piston (and around lugs, if the piston is of the type with lugs), for which manual welding is used; and worn ring grooves, for which the automatic or semiautomatic processes are more efficient, provided the number of pistons to be reclaimed warrants the cost of automatic equipment.

Whether or not a damaged piston warrants reclamation depends upon a number of factors—the extent of the surface involved, the character of the damage and whether its location is such that it can be repaired by continuous welding while the piston is being revolved on turning rolls or by some other device. If the piston is badly scored, it is difficult to prepare and the welding usually must be done largely with a manual holder while the piston is stationary rather than revolving. Damaged surface areas near mid-height require intermittent manual operation because the surface is interrupted by the wrist-pin bore.

On the other hand, even when the main compression seal-ring grooves near the top of the piston are worn

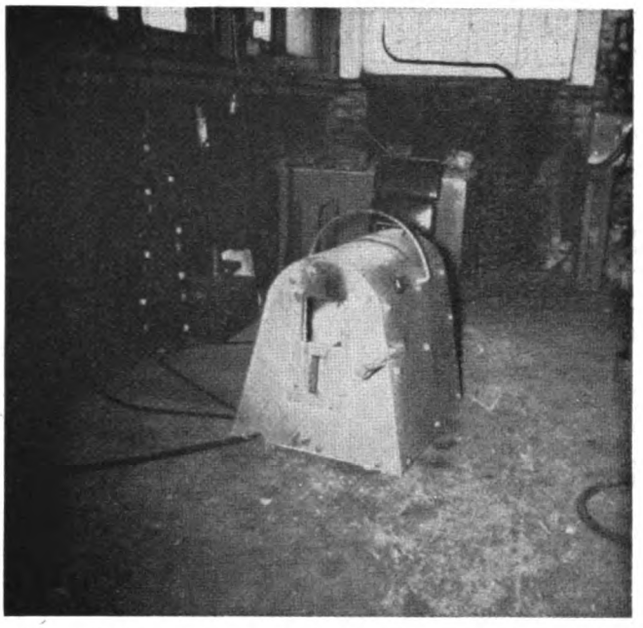


Fig. 3—Insulated cover placed over aluminum piston during welding of ring-groove areas by the tungsten-arc process. The opening in the end of the cover is for insertion of the oxyacetylene heating torch

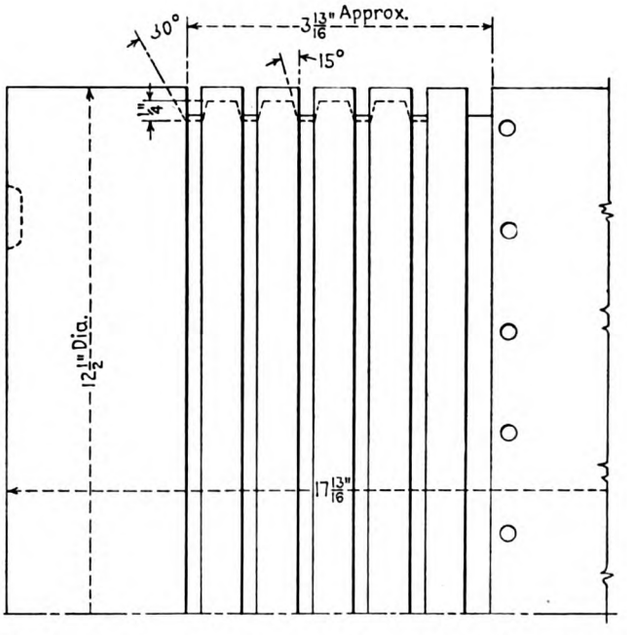


Fig. 4—Diagram showing extent of machining of worn ring-grooves of aluminum piston, 12½-in. diameter by 17 13/16 in., in preparation for reclamation by inert-gas-shielded-arc-welding

quite badly, resulting in slap and blow-by or loss of compression, it is economical to repair such damage. Also a limited amount of localized cracking or spalling, and often a moderate amount of scoring can be repaired to good advantage by welding. Experience in any shop will indicate how badly a piston may be damaged and still be worth while reclaiming.

Both of the inert-gas-shielded welding processes that have been mentioned are available in either the manual or automatic type. Sometimes the manual gun of the

TABLE I—PROCEDURE FOR WELDING RING GROOVES WITH AUTOMATIC AIRCOMATIC HEAD

Preheat	300 to 350 deg. F.
Welding current	330 to 375 amp., d.c. (long arc)
Filler metal wire	1/8 in. diameter, 43S aluminum
Shielding gas	Helium
Revolving speed of piston	1 1/3 to 3 r.p.m.
Number of layers deposited	Six (three in the machined grooves and three across the full width of the ring-groove area being repaired)

Remarks: No auxiliary cooling nor heating used during welding. Temperature of piston at finish of welding is 600 to 700 deg. F. After welding, piston is allowed to cool slowly in a preheated furnace or steam-heated cabinet.

TABLE II—PROCEDURE FOR WELDING RING GROOVES WITH AIRCOMATIC MANUAL GUN MOUNTED ON A FIXTURE

Preheat	300 to 350 deg. F.
Welding current	300 to 330 amp., d.c.
Filler metal wire	3/32 in. diameter, 43S aluminum
Shielding gas	Helium
Revolving speed of piston	1 1/3 r.p.m.

Remarks: Same as for Table I. The time required for welding a piston with the manual gun is substantially greater than that required with the automatic head.

TABLE III—PROCEDURE FOR WELDING RING-GROOVES BY THE TUNGSTEN-ELECTRODE INERT-GAS-SHIELDED PROCESS

Preheat	400 deg. F.
Welding current	375 to 425 amp. (balanced a.c.)
Filler-metal rod	3/16-in. diameter (5% drawn silicon aluminum)
Electrode	3/16-in. tungsten
Shielding gas	Argon
Revolving speed of piston	As required for manual feeding of filler rod
Number of layers deposited	3 to fill machined grooves and 3 layers over entire width of ring-groove area being repaired

Remarks: Water-cooled holder with water-cooled nozzle. Piston heated during welding to keep heat uniform, but temperature of piston kept under 500 deg. F. After welding, piston is allowed to cool slowly in a preheated furnace or steam-heated cabinet.

filler-wire-electrode type (which is semiautomatic) is clamped with a nozzle in a vertical position over a revolving piston to build up worn ring grooves.

The application of one or the other of these inert-gas-shielded welding processes for reclaiming the large one-piece types of aluminum pistons has now become quite widespread. Although some experimental work has been done on a smaller type of piston with a shrunk-on sleeve that carries the upper ring-grooves, the reclamation of this type has not been developed to the stage of practicality, except to replace the ring carrier with a new one.

Savings by Welding

Cost figures from one source indicate that when all the ring grooves require rebuilding, for a one-piece aluminum piston of the type with lugs on the head, and when the machining to prepare it for welding is done as shown in Fig. 4, the total cost of reclamation, including preparatory machining, welding, finish machining, incidental operations and overhead, is less than 20 per cent of the cost of a new piston and less than 40 per cent of the previous reclamation cost. For the larger more costly type with dished head and no lugs, the total reclamation cost is little more than 15 per cent of the cost of a new piston. Very frequently only one or two ring grooves at the top need rebuilding, and the time and cost are considerably less. The time required for welding one of these pistons varies from 30 to 75 min., depending upon the extent of the wear or damage.

Some diesel manufacturers have proposed the use of replacement rings that are oversize in width a sufficient amount to permit the machining of worn ring grooves, rather than repairing the piston by welding and then machining it to fit standard-width rings. However, since this practice requires the stocking of two sizes of rings, it may cause confusion, and experience indicates that railroads, in general, prefer to reclaim the pistons and to stock only standard-width rings.

To facilitate continuous operation in building up worn ring grooves, the piston can be mounted on a turning-roll type of positioner with knurled rollers, driven by a small motor such as those that are used for driving small oxyacetylene cutting machines, equipped with a foot-switch control that will also reverse the direction of rotation.

Alternatively the piston may be mounted on a lathe-type fixture which causes it to revolve, with both ends of the piston supported; and in the case of automatic welding, the progress of the electrode holder is governed by the travel-carriage mechanism of the lathe, as it travels along the length of the ring-groove area.

The procedures that have been used for the inert-gas-shielded process with filler-wire electrode to weld aluminum pistons are given in Tables I and II, when preparatory machining is done as shown in Fig. 4.

Use of Manual Holders

It is sometimes convenient to use the manual gun employed for welding cracks in piston heads to supplement fully automatic equipment, when the volume of reclamation work occasionally runs more than can be handled expeditiously with one automatic head. When the gun is manually guided, as in the welding of cracks in piston heads, a lower welding current is used, about 260 amp.

The welding is started at either end of the ring groove area that is to be built up, and it progresses toward the opposite end as the piston revolves. At the end of depositing each layer, the welding tip or head is raised a moment and the new layer is started, progressing in the opposite direction, and so on until the welding of the area is completed.

For the Tungsten-electrode process, the water-cooled manual holder with water-cooled tip is used, held by the operator rather than being mounted on a fixture, and the filler metal is fed into the arc by hand, rather than employing a filler-wire feeder. When the volume of work is sufficient to justify the extra cost of providing fully automatic equipment, the use of the metal-arc process with filler-wire electrode is preferable because of its lower operating costs for this kind of an application.

When the Tungsten-electrode process is used, the rate of heat input is much less, and therefore the piston is enclosed in an insulated housing (Fig. 3). Also an oxyacetylene torch is mounted at the skirt-end of the piston and is kept playing on the inside of the skirt as the piston revolves, to supplement the heat of the arc welding on the ring-groove areas, and to keep the heat distributed uniformly.

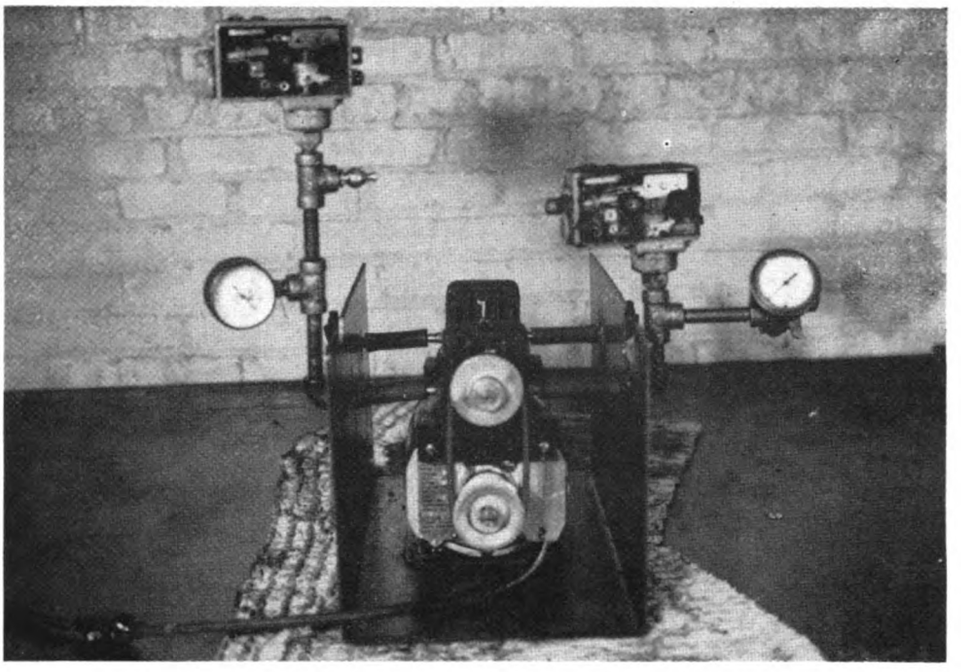
The procedure used for the Tungsten-electrode process in this application is given in Table III.

As a typical example, one shop has reported that it requires about 2½ hr. per piston for reclamation by the tungsten-arc process, when only the top ring-groove must be rebuilt and some eight thermal cracks repaired in the head of the piston; and 5 to 6 hr. when the entire ring-groove area is rebuilt.

Regardless of what process is used, the piston is soaked first in a carbon solvent for cleaning, and all cracks are carefully veed out down to sound metal.

Experience has shown that when proper procedures are used, pistons reclaimed by any of the inert-gas-shielded arc processes will stand up in service at least as well as new pistons.

Small pump for testing ➤ pressure switches at the North Western's Kinzie street shops in Chicago. Positive pressure is checked by the gage arrangement at the left; vacuum, at the right



⮟ Cart used in the engine repair room of the Kinzie street shops carries a complete set of tools for assembling or dismantling a Diesel engine. The cart is one of four individually assigned to a workman. It rides on rubber tires and saves running back and forth for small groups of tools as the work progresses



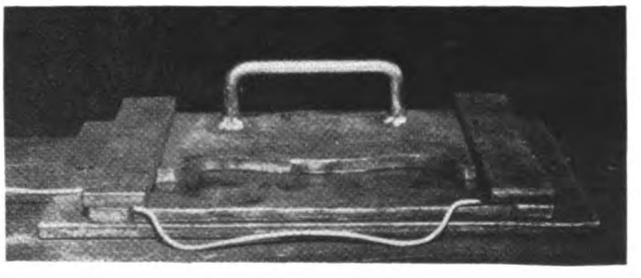
⮟ Arrangement for checking connecting rods on the Great Western at Oelwein, Iowa. The dummy bearing in the background is in two sections, with the outer ring slightly eccentric. Lining-up marks on each ring give standard lengths. Feeler gages show deviation from the standard length



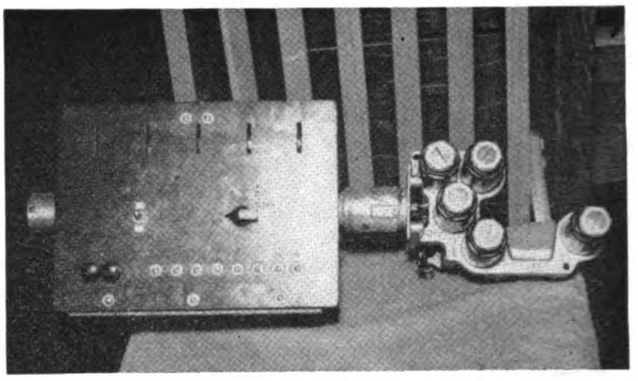
⮟ Rack in use on the North Western for storing front end housings, back end housings, flywheel rings, flywheel plates and covers for various housings. It is built from scrap 2-in. flues and ¼ in. by 2 in. strap iron with a flooring of 3/16-in. plate. The floor is 14 in. above the shop floor to permit movement by lift truck



⮟ Cutting plate used by the Great Western both to cut and shape piston clearance leads simultaneously. The lead wire is run through holes on the two side guide bars and the wire is shaped and cut by pulling the center sliding plate towards the operator



Test Box for E.M.D. Governors



The solenoid coils and the leads to each solenoid on Electro-Motive diesels are tested at the Parsons, Kan., shops of the Katy by an easily carried test box equipped with a light. Coils are tested individually by plugging the assembly into one end of the box (the right in the illustration).

The box is wired to bring out to its terminals the leads of each solenoid and of the low lube oil switch for measuring resistance and for circuit testing with an ohmmeter. With a 74-volt supply across the terminals of the box, the selector switch is moved to test each individual coil.

The locomotive governor cable is plugged into the other end of the box. When the throttle is operated, lights indicate whether a circuit exists to each solenoid to tell if they are properly actuated by movement of the throttle.

Assembling Liner And Water Jacket

The Springfield, Mo., shops of the Frisco have an excellent arrangement for assembling Alco liners to the water jackets which prevents pinching or nicking the water seals. The jacket fits in an opening in the top of the bench and is secured by cap screws; the liner is pressed in by a lever arrangement. The piston rack is adjacent to the work bench, and the jackets and liners are handled by a crane which extends between these two points.

Fig. 1 shows the operation of the lever to press the liner in place and the use of the tool to avoid damaging the liner seal. Fig. 2 illustrates how final alignment is made between the liner and the jacket, and shows the construction of the tool for saving the seal.

The lever arrangement is used in conjunction with a wooden block to press the liners in place. As an added help in providing a nearly direct downward vertical force, there are three adjusting holes at the fulcrum to keep the lever about horizontal at all positions of the entering liner. The lever pins are secured in each hole with a cotter key. When not in use, the lever is held in an upright position out of the workman's way by a safety catch on the base.

Final small adjustments in the alignment of the liner to the jacket are made by a pinch bar with one end against the base of the lever. The liner-jacket unit is then assembled to the piston and rod assembly by placing it over the latter with the crane.

The small tool shown near the bottom of Fig. 2 has a half-ring on the end. This is inserted in the water inlet hole as shown in Fig. 1 to guide the bottom liner seal past this hole in the water jacket as the liner is being forced in, thereby preventing damage to the seal.

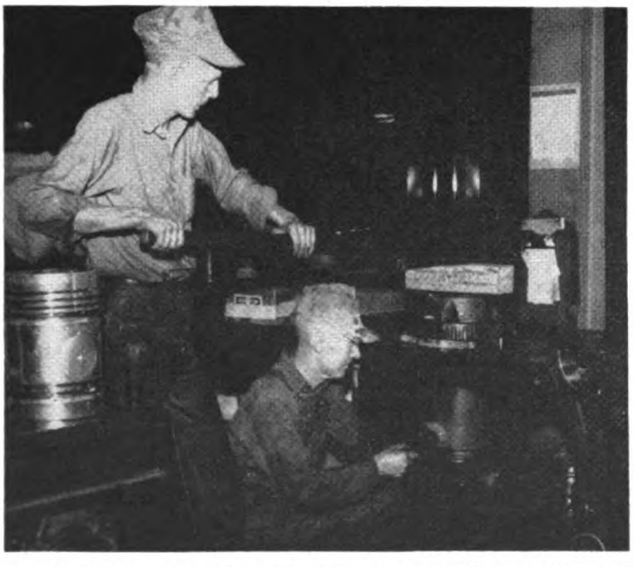


Fig. 1—Applying an Alco liner to the water jacket. The tool shown inserted in the water inlet hole prevents damage to the liner seal by guiding it past this hole. After fitting the liner to the jacket, the assembly is placed over the assembled piston and rod on the rack at the left

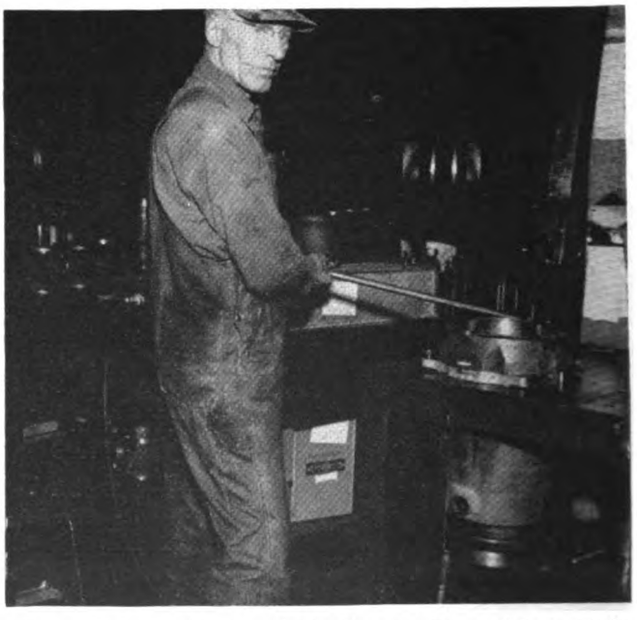
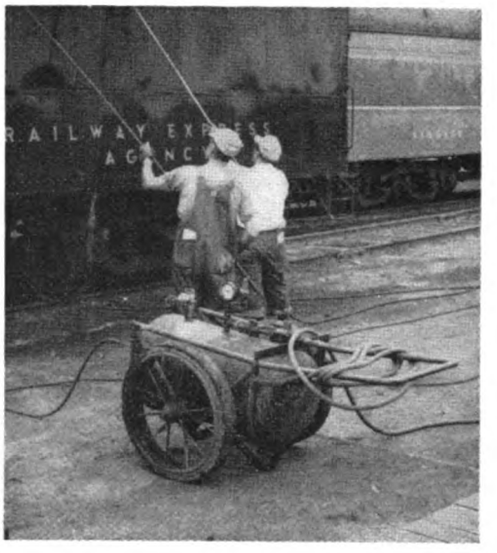


Fig. 2—Final alignment of the liner to the jacket is made by a pinch bar. The tool for preventing liner seal damage is hanging at the bottom

Short Cuts in Car Work from the Union Pacific

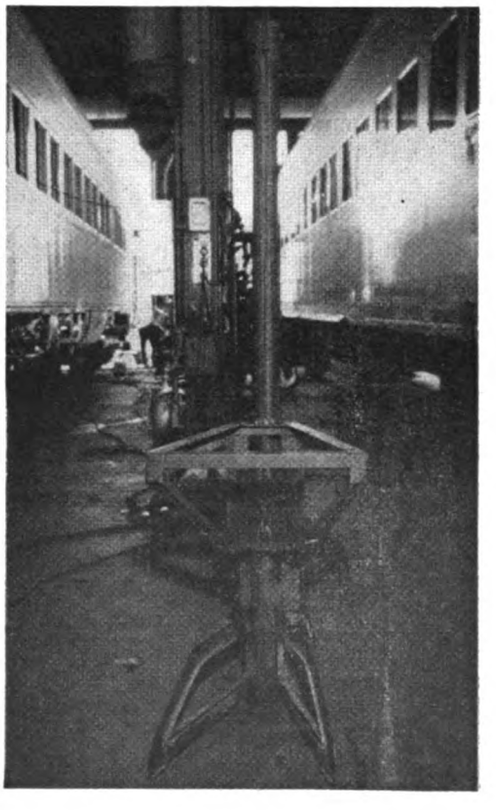


▲ A portable pressure tank for spraying cleaning solution which has resulted in a saving of about 50 per cent both in cleaning solution and time over hand methods. The tank is operated by air pressure from the yard air line reduced to 35 p.s.i. Rinsing is done with a fountain-head spray

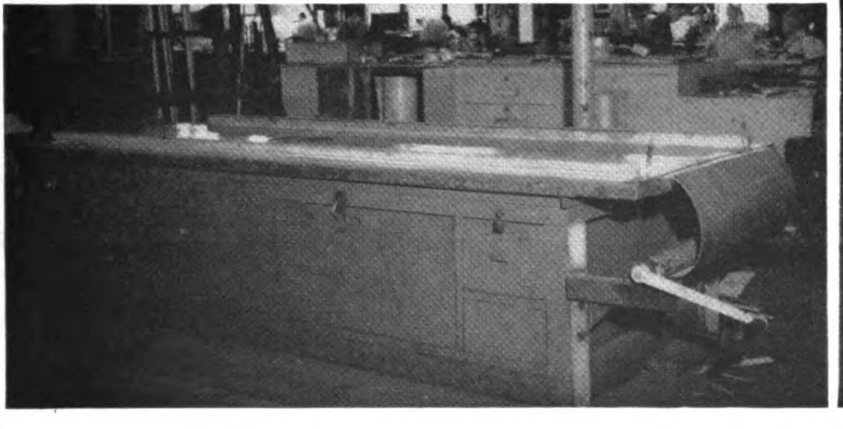


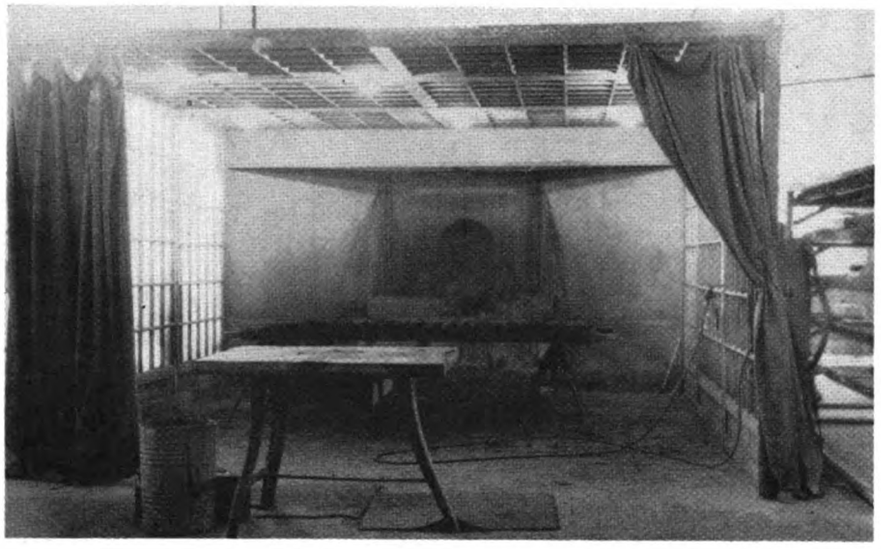
◄ Scaffold hangers running on a separate line give access to an entire car side for body rubbers and other suspended tools. The cord on one side is for the machine; the other, for the counterweight

► Air conditioning system evaporator hoist used by the Union Pacific at Omaha for applying the evaporator to the car.—The Table which holds the evaporator is lifted by a pulley arrangement worm gear driven from a crank handle—It is in three easily knocked down parts (the base, the table and the upright) for carrying in and out of the car



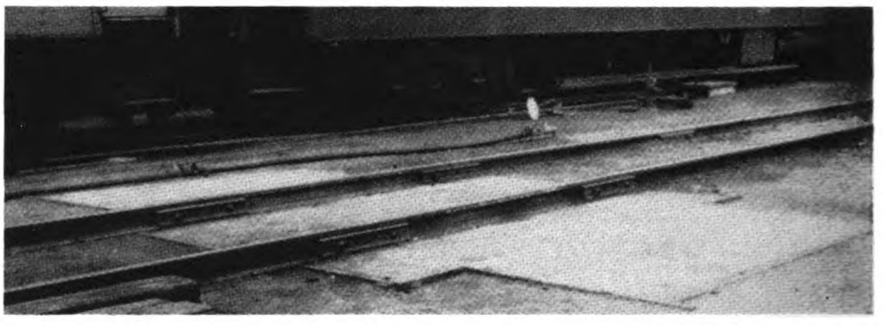
▼ Quick and accurate way to cut passenger-car rubber-floor covering to the correct width. The arrangement has a roller on each end and a crank on the right, or cutting, end. The crank draws the covering past the two knives on the table to trim the roll to the correct width. Trimming to length is done in the car



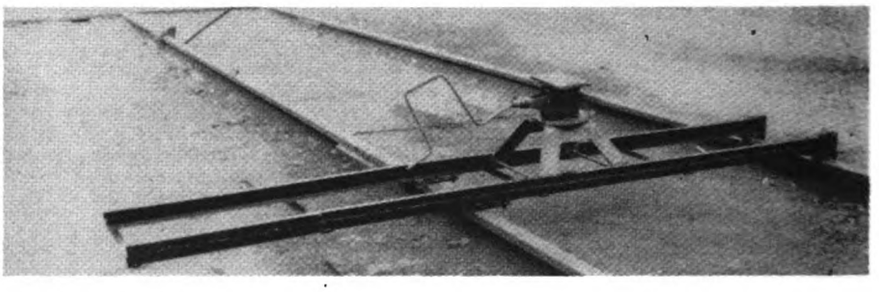


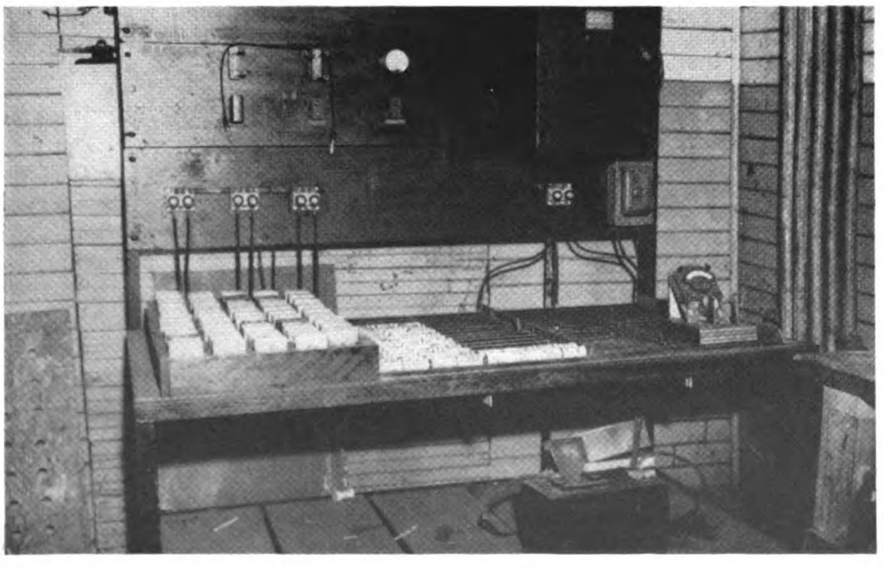
▼ This layout at Council Bluffs is for removing passenger-car generators and other heavy underneath parts. The car is spotted over the concreted area, and the short section of rail on one side removed by loosening the rail joint bolts. The part is then dropped on a dolly which is easily moved into and out of working position over the concrete without any rail obstruction

▲ A well lighted and adequately ventilated room for paint spraying small parts, on the Union Pacific at the Omaha shops

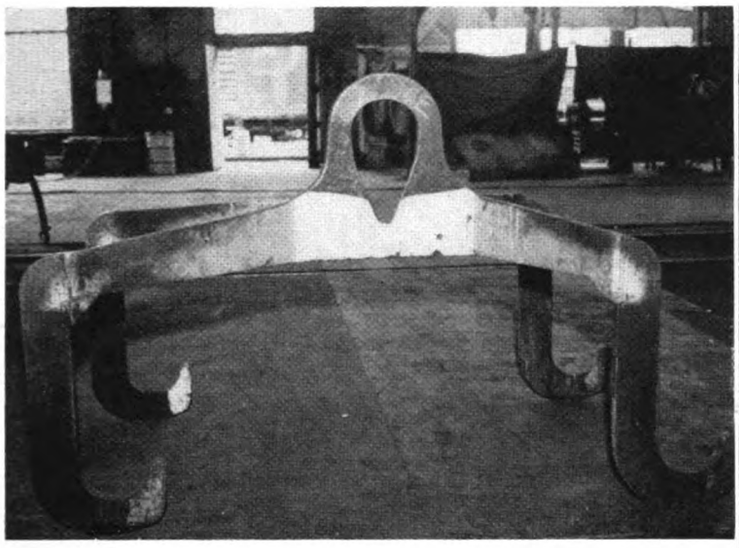


➤ Arrangement for lifting or removing universal air-brake-control valves on passenger cars in the yards. The carriage is on rollers for movement along the track, and the jack is on rollers for movement along the carriage. Lifting is done with the light scissors jack

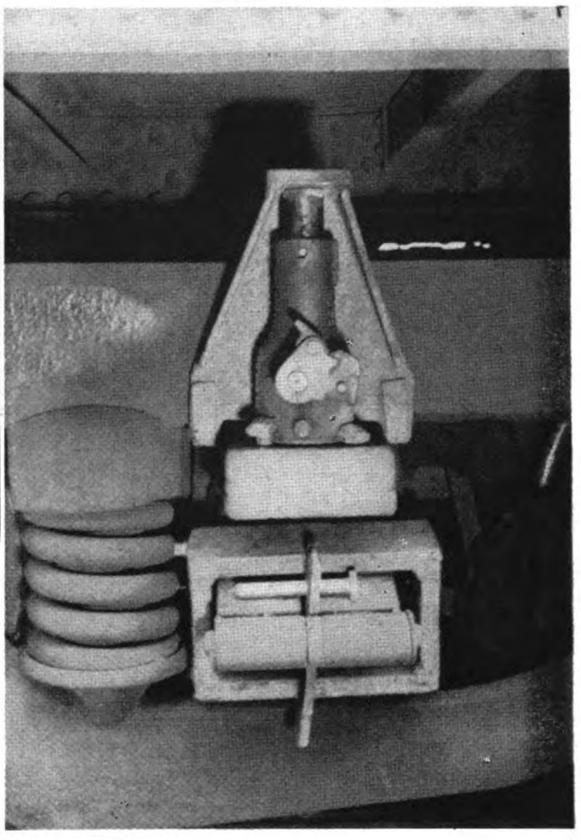




◄ The Union Pacific has found that dry cells can be given up to six recharges with the above layout installed at Council Bluffs—The table holds 49 lantern batteries and 256 flashlight batteries—A 6-volt current is applied across each of the lantern batteries, and across the flashlight batteries in series of fours—The test for serviceability is made with a voltmeter



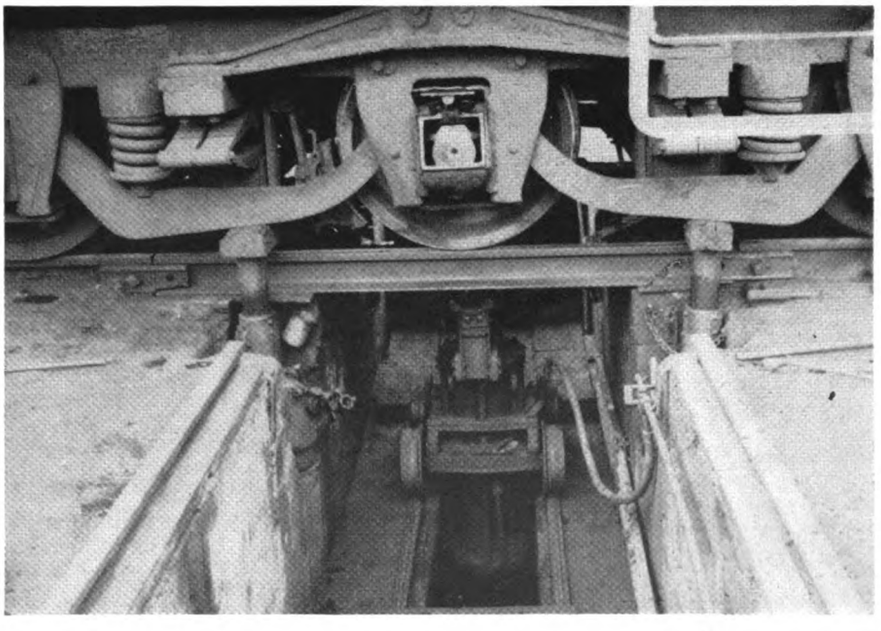
▲ A sturdy lifter for moving all types of four-wheel trucks around the Omaha freight-car shops



▲ Jig to clamp elliptic truck springs for removal —The jaws of the jig fit under the bottom of the truck side frame, and the jack rests on the truck bolster secured by two bolts which drop through holes in the end of the bolster—After the eliptic spring is compressed, the rectangular member is slipped over and secured with a key and pin to hold the spring compressed



▲ Roller-bearing holders made at Council Bluffs shops to keep boxes from tipping and allowing water to enter the hole in the back

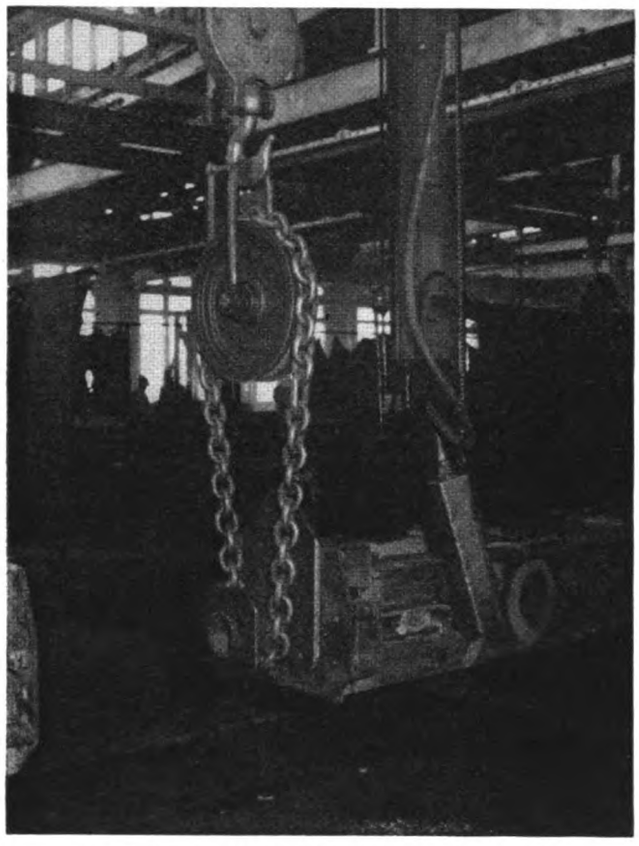


➤ Jacks are recessed in the corners of the drop pit at Council Bluffs to save jacking up the entire end of a car—The 50-ton jacks serve to take the strain off the equalizer

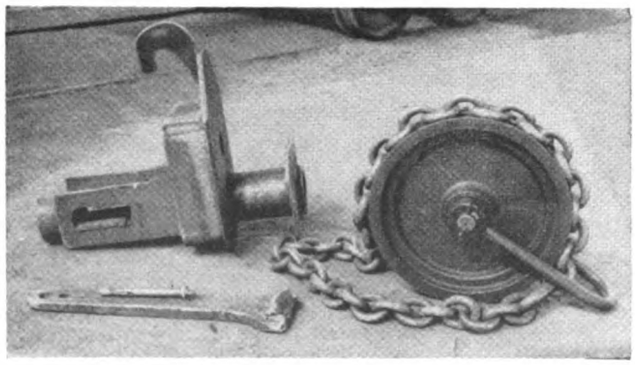
Three Santa Fe Car Shop Devices

Underframe Turner

The Atchison, Topeka & Santa Fe has devised a simple underframe turner for use in its Topeka shops. The member on the left in the close-up view fits into the coupler opening. The key in front of this member goes in the draft-gear-key slot in the underframe.



The underframe turner in the operating position



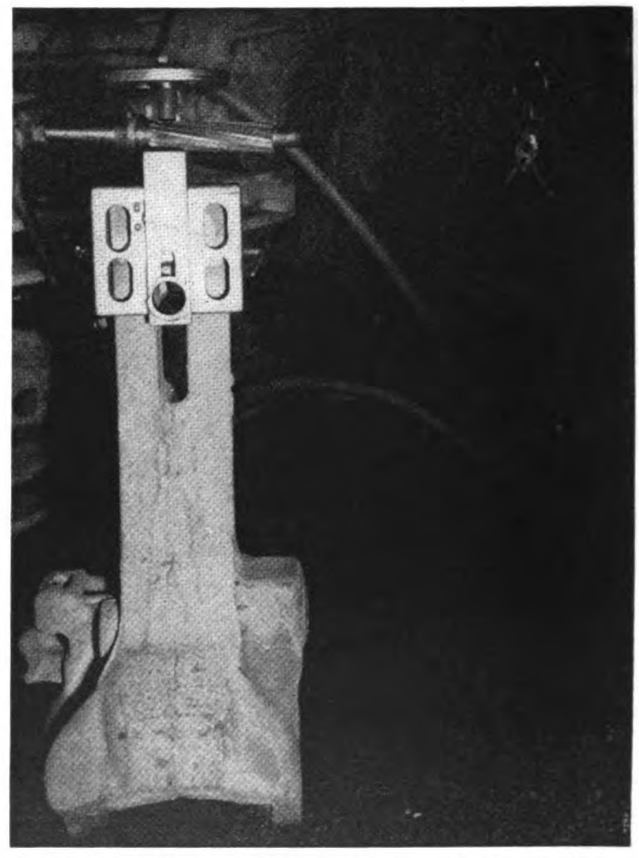
The three principal members of the turner

With one such arrangement in each end of the underframe as shown in the operating view, turning is accomplished in either of two ways. If the air brake parts are applied, the underframe is enough heavier on one side that it flops over by itself upon being lifted. In other cases this can easily be done by hand.

Reaming Built-Up Couplers

When the key slots in the butt ends of freight-car couplers have worn elongated from service, they are reconditioned by building up the pulling end of the slot by welding and then reaming it to standard size.

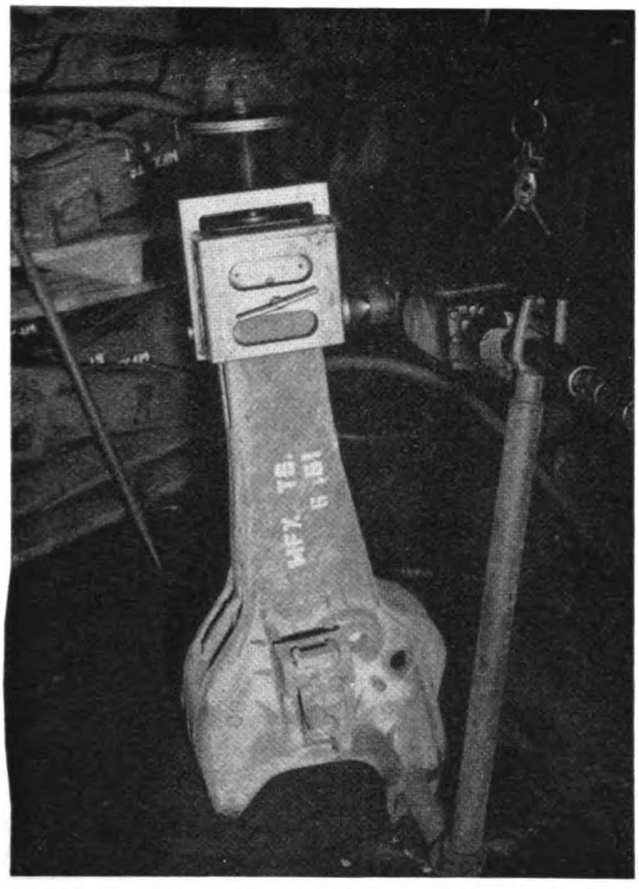
A holding stand for the reamer fits over the butt end of the coupler and is secured in place by two set screws.



The reamer is fed into the built-up pulling end of the coupler by a hand feed wheel

This holder has a vertically sliding section with a hole to guide the reamer, and this section is moved up and down by a hand fed wheel to bring the reamer against the built-up section of the slot.

The reamer is turned by a conventional shop air motor. The motor is supported by an L shape stand, made of 1¼-in. pipe, the horizontal leg of which fits in the



Arrangement for reaming the built-up pulling end of coupler slots, showing the method of supporting the air motor

knuckle pin hole. The vertical leg resists the torque of the motor through a U shape bar on top into which the handle of the motor fits.

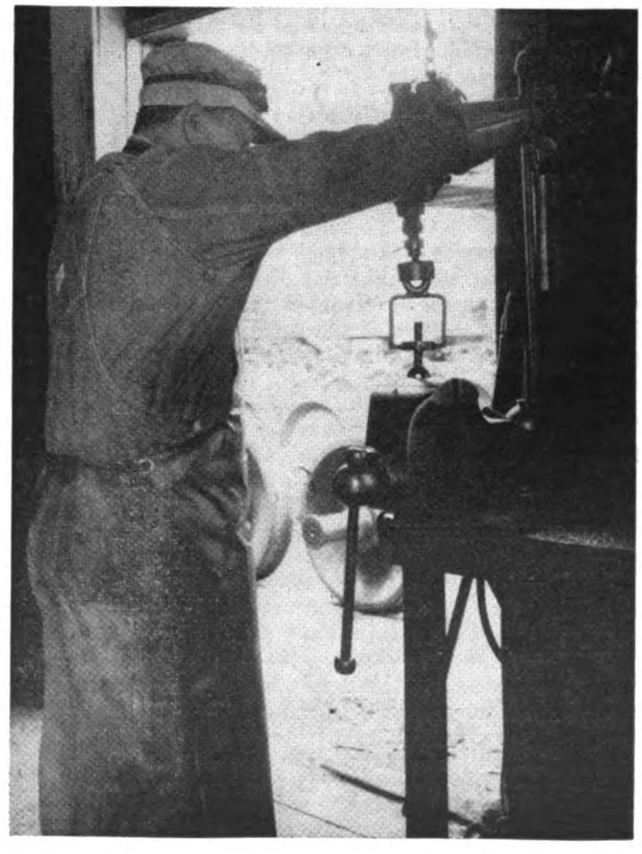
Reworking Evans Auto-Loaders

At Argentine, Kan., a fast and economical method of reconditioning the chain assemblies of Evans auto loaders has been developed. A counterbalanced air motor is used for the operation in conjunction with a special chuck and fittings for the taps and dies.

The special chuck is attached to the air-motor shaft through a swivel joint and is in the shape of a solid drum except for a groove milled out of the bottom. The width and shape of this groove is such that it mates with the top of an eye from an eye bolt, and in this manner drives the tap or die. The other end of the eye is welded to the die holder or to the tap as the case may be.

The taps tap out the turnbuckle to $\frac{3}{4}$-in., $\frac{25}{32}$-in. and $\frac{13}{16}$-in. sizes to take care of progressive wear. The dies are the same sizes, and both are used in right- and left-hand thread styles. The die holder is machined for the dies to fit, and they are secured in place by two set screws.





Above right: Tapping out the turnbuckle on the chain assembly of an Evans auto loader

Right: The die holder is driven by the air motor through a special chuck with a groove machined to mate with the eye on top. The dies are secured in the holder by two set screws

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Cylinder Liner and Water Jacket

250-Q.—Does the cylinder liner fit tight into the water jacket? A.—No. A sealed water space is provided between the liner and jacket.

251-Q.—What term would be used for this type of liner? A.—It is called a wet liner, as the space between the liner and block is used for a water jacket.

252-Q.—What provides the sealed water space between the liner and jacket? A.—They are assembled together with rubber gaskets.

253-Q.—How many gaskets are provided? A.—Two seal rings on the lower portion of the liner and one on the top flange of the jacket.

254-Q.—How does the assembly seat in the cylinder bore? A.—With a safety gasket at the bottom of the water jacket.

255-Q.—What is the purpose of the tell-tale hole in the water jacket? A.—To give indications of a leak past the seal rings.

256-Q.—How is accurate clearance volume maintained? A.—With a metal to metal fit between the cylinder head and liner and liner assembly to frame.

257-Q.—How is the liner cooled? A.—Cooling water enters the liner assembly through a jumper at the bottom of the jacket. It then circulates around the liner, cooling the walls and then passing to the cylinder head through rubber grommets.

258-Q.—What is the purpose of the flutes on the liner? A.—For strength. Also to separate the flow of water and increase its velocity.

Connecting Rod and Crankpin Bearings

259-Q.—What kind of connecting rods are used? A.—High strength, alloy steel drop forgings.

260-Q.—What type crank pin bearings are used? A.—Precision type.

261-Q.—Describe the connecting rod further? A.—There are oil grooves in the big end of the rod and it is rifle drilled for oil passage to the upper end. A bronze bushing is pressed into the eye of the small end of the rod. The cap is the conventional box type, aligned to the rod by a dowell and extended lips.

262-Q.—How many bolts are used, and are the caps interchangeable? A.—Four bolts are used to secure the cap to the rod. Caps of different rods are not interchangeable.

Cam Shafts and Camshaft Bearings

263-Q.—How many camshafts are on the diesel engine? A.—Two cam shafts, one for each bank of cylinders.

264-Q.—How many cams are on the camshafts? A.—There are three cams for each cylinder, as follows: (1). Air Inlet—(2). Fuel Injection—(3). Exhaust.

265-Q.—Is the camshaft all in one section? A.—No. Each camshaft is in three sections for the 12 cylinder engine and four sections for the sixteen cylinder engine, covering two cylinders each.

266-Q.—At which point are the sections bolted together? A.—At the third and fifth camshaft bearing for the 12 cylinder engine and at the third, fifth and seventh for the 16 cylinder engine.

267-Q.—How many bearings does each camshaft have? A.—Nine for the 16 cylinder engine and seven for the 12 cylinder engine. The lower half of each bearing pedestal is cast integral with the camshaft casing.

268-Q.—Are the cams a part of the camshaft? A.—Yes. The cams are forged integral with the shaft and are accurately machined, heat treated and hardened.

269-Q.—How is the assembly lubricated? A.—Lubricating oil is supplied under pressure to the individual camshaft bearings. The cams run in a bath of oil supplied by the camshaft bearings and rocker arms. The oil traveling down the push rod tubes lubricates the cam followers and crossheads.

270-Q.—How many camshaft casings are on the engine? A.—There are two cam shaft casings on the engine, one on each bank of cylinders.

271-Q.—Are the cam shaft casings interchangeable? A.—No.

272-Q.—How is the lower portion of the casing made? A.—The lower portion of the casing is so cast as to create a lubricating oil reservoir which will rise to a predetermined level, controlled by an overspill hole returning oil to engine base sump.

Crank Shaft and Main Bearings

273-Q.—How is the diesel engine crankshaft made? A.—It is made of special steel alloy. The main and crankpin journals are made especially large to obtain utmost rigidity and low bearing loads.

274-Q.—How many crank throws is the crankcase equipped with? A.—There are eight crank throws on the sixteen cylinder engine and six on the twelve cylinder engine, on each of which are mounted two connecting rods side by side.

275-Q.—What provision is made for lubrication? A.—Drilled lubricating holes are provided between the main and crank pin journals.

276-Q.—Describe the generator end of the crankshaft. A.—On the generator end of the crankshaft, the drive gear is of the split type bolted in place while the generator flange is integral with the shaft.

277-Q.—Describe the free end of the crankshaft. A.—At the free end there is a flange for mounting the vibration damper, drive gear for both oil and water pumps, and the extension shaft.

278-Q.—Describe the main bearings. A.—They are of the underslung type. The upper bearing saddle is a part of the engine frame. The lower saddle is the cap which is secured by two bolts.

279-Q.—How is accurate location of the cap taken care of? A.—The cap joint is tongue and groove to insure accurate location and maximum rigidity under working loads.

280-Q.—Are the bearing caps interchangeable? A.—No. Do not mix them up. On the right side of each cap on the outer lip is stamped the bearing cap number and engine serial.

281-Q.—How are the bearings located as to number? A.—The No. 1 bearing is at the free end of the crankshaft.

282-Q.—What serves to prevent rotation and longitudinal motion of the main bearing shells? A.—A shell lock in cap prevents rotation and longitudinal motion.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

283-Q.—What is done to insure bearing lubrication? A.—The shells are grooved to distribute lubricating oil on the bearing as well as to supply oil to the connecting rods for lubrication and piston cooling.

Main Frame and Base

284-Q.—What is the function of the Main Frame? A.—The main frame houses and supports important components of the engine.

285-Q.—Describe the main frame. A.—It is of all steel welded construction. The upper halves of the main bearing supports are welded to the frame, forming a rigid mounting, carrying the crankshaft.

286-Q.—How is the main base constructed and how is it related to the main frame? A.—It is of all welded steel construction. The base and frame are securely bolted together approximately in line with the crank shaft position.

287-Q.—What else is attached to the main base? A.—Welded to the base are two pads which support part of the Diesel engine weight and form the mounting of the base on the locomotive frame. A generator adaptor rigidly bolts to the base at one end and has two additional pads which fasten to the locomotive frame, giving four point mounting.

Schedule 24 RL

Air Brakes

Train Control Operation (*continued*)

1161-Q.—Suppose that a suppression valve is not used? A.—Passage *5* leads to stop reservoir pipe *5*, stop reservoir, through the 3/8 in. check valve, passage *8* in the brake valve and connecting passages to atmosphere.

1162-Q.—What are the connections if a suppression valve is used? A.—Passage *5* leads to pipe *5* and passage *6* on the suppression valve, through the valve and out passage *8*, pipe 8, and brake valve to atmosphere.

1163-Q.—What insures the movement of brake valve service application piston to its upper position? A.—Choke *K* in the piston prevents build up of air from chamber *A* below the piston into chamber *B*, hence the piston is moved upward due to the reduction in chamber *B*.

1164-Q.—What would be the result if the brake valve handle is moved to Lap position? A.—Passage *8* in the brake valve is closed to the exhaust.

1165-Q.—Does this prevent piston 112 from remaining in its upward position? A.—No. The air from chamber *B* on top of piston *112* is quickly vented past upper valve *82* in the timing valve into the stop reservoir pipe and the stop reservoir.

Cab Signal Operation

1166-Q.—How does the air flow to the timing valve? A.—From the reducing valve through the strainer in the pipe to the timing valve through two supply branch pipes.

1167-Q.—How does the air flow from branch 1? A.—Branch pipe No. 1 permits air to flow past lower magnet valve *243*, which is unseated when the timing valve magnet is energized, to ball check *27*, which is lifted, supplying air to the chamber below piston *90*.

1168-Q.—Where else does reducing valve air flow? A.—Through the combined change-over switch and cock direct to the chamber below piston *90*.

1169-Q.—What does this insure? A.—That piston *90* remains in its upper position at all times in cab signal service.

1170-Q.—What happens when a cab signal indication is received by the timing valve magnet? A.—The magnet is de-energized.

1171-Q.—What movement occurs when the magnet is de-energized? A.—The spring moves lower valve *243* and upper valve *240* upward. Lower valve *243* is seated and upper exhaust valve *240* is unseated.

1172-Q.—What is accomplished by the movement of these two valves? A.—When the lower valve is seated air supply from pipe *1* is cut off, and when the upper valve is unseated, reducing valve air from the combined change-over switch and cock flows through the chamber below piston *90*, through choke *X* at the ball seated check valve *27*, and past unseated exhaust valve *240* to the timing valve whistle and the fireman's call signal circuit controller.

1173-Q.—How long does the timing valve whistle blow, and the fireman's call signal operate? A.—Until the cab signal changes to a less restrictive indication, or unless acknowledgment is made.

1174-Q.—What would then happen? A.—In either case the timing valve magnet is energized.

1175-Q.—With the energization of the magnet what takes place? A.—The upper exhaust valve is seated, cutting off air supply to the timing valve whistle and the fireman's call signal circuit controller. The lower valve is unseated, permitting charging of the cab signal system.

Operation of A-1 Suppression Valve

1176-Q.—What can be done to prevent a train control application? A.—The brake should be applied manually.

1177-Q.—What does this accomplish? A.—A brake application of prescribed amount will suppress the train control brake application for a limited time, which may be sufficient to reduce the speed below the speed restriction in effect.

1178-Q.—In this case how may the brakes be released? A.—The brakes may be released in a normal manner.

1179-Q.—What is the result if the train is approaching a restricted signal under this temporary suppression condition? A.—If the signal clears, the brake may be released in the normal manner and train can proceed without being brought to a stop if the speed and length of train permit.

1180-Q.—What action is taken to obtain suppression when operating the automatic brake system? A.—Move the brake valve handle to service or first service position within less than six seconds at sounding of the warning whistle.

1181-Q.—What is the procedure, if service position of the brake valve is used? A.—Make a brake pipe reduction of moderate amount for temporary suppression in freight service, or a full service brake pipe reduction in passenger service for permanent suppression.

Steam

Locomotive Boilers

By George M. Davies

Tapping Firebox Sheets

Q.—When applying radial stays and crown stays is it necessary to tap both sheets simultaneously with special taps to insure maintaining the lead of the threads through both sheets?—F. E. D.

A.—The general practice is not to maintain the lead of the threads through both sheets when tapping for long radial stays and crown stays as the elastic yielding of the bolts and the sheets is sufficient to take up the difference

in lead. However, this practice is not universal, in that some railroads maintain the lead from end to end by the use of such equipment as double headed threading machines with the heads adjustable for maintaining lead when simultaneously threading both ends of the staybolts of different lengths, also long ground taps for threading the sheets for the lower radials, and taps mounted on threaded guide bars, with the threads set in lead, for tapping the sheets for the application of crown stays.

Welder's Qualifications

Q.—Is a welder qualified indefinitely?—M. V.

A.—The operator qualification tests vary on the different railroads, but as a general rule the operator qualifications tests once complied with remain in effect indefinitely unless the operator is not engaged in a given process of welding for a period of three months or more or there is some specific reason to question his ability.

Why Butt-Weld Shell Courses?

Q.—What is the purpose of butt welding the shell courses together at each end of the riveted longitudinal seams for a distance of approximately 12 inches?—V.B.F.

A.—The A.S.M.E. Code provides that the ends of inner buttstraps of riveted buttstrap longitudinal joints may be fusion welded to the edges of the heads or of the adjoining shell plate, or to circumferential buttstraps for tightness, provided the carbon content in the steel does not exceed 0.35 per cent. When the buttstrap of a longitudinal joint does not extend the full length of the shell plate, the abutting edges of the shell plate may be welded provided the distance from the end of the buttstrap to the edge of the flange of the head or adjacent shell plate is not greater than 2½ inches. On locomotive boilers the outside buttstrap is not extended to the adjacent shell course to provide for caulking the edge of the outside buttstrap leaving a short distance of the longitudinal joint of the shell plate exposed. Originally this section of the joint was sealed with a plug which is now discontinued in favor of seal welding.

Reinforcement at Syphon Openings

Q.—On locomotive fireboxes equipped with syphons, is it necessary to reinforce the firebox crown sheet to compensate for the opening in the crown sheet?—F. M. P.

A.—The A. S. M. E. Code for Locomotive Boilers provides that openings for Firebox Syphons shall be reinforced as follows:—

In locomotive fireboxes, with or without combustion chambers, which are equipped with staybolted syphons, the openings in the crown sheet shall be reinforced as outined below:

(1) If more than 40 per cent and not more than 50 per cent of the total length of the crown sheet is removed, not less than 10 per cent of the removed longitudinal ligament shall be restored.

(2) If more than 50 per cent and not more than 60 per cent of the total length of the crown sheet is removed, not less than 20 per cent of the removed longitudinal ligament shall be restored.

(3) If more than 60 per cent and not more than 70 per cent of the total length of the crown sheet is removed, not less than 30 per cent of the removed longitudinal ligament shall be restored.

(4) If more than 70 per cent of the total length of the crown sheet is removed, lot less than 40 per cent of the removed ligament shall be restored.

Maximum Diameter of Staybolts

Q.—What maximum diameter of staybolts should be used in staying the fireboxes or waterlegs of locomotive boilers? There appears to be a difference of opinion.—M.C.

A.—The maximum size of staybolts to be used in staying locomotive fireboxes is limited by the Interstate Commerce Commission to 7,500 lb. per sq. in. of net cross-sectional area. Thus the spacing of staybolts is definitely limited for any given condition of plate thickness and boiler pressure and the required size of staybolt to support this area is readily computed.

The proceedings of the Master Boiler Makers Association recommends that ⅞ in. diameter staybolts be applied as a minimum and that 1-in. diameter be the maximum size and that bodies of rigid staybolts beyond 1 in. be turned down to $^{25}/_{32}$ in. between the sheets.

Using maximum diameter staybolts to support a given area, with the idea of keeping down the number of staybolts used is not desirable; smaller diameter staybolts are more flexible and give greater life to fireboxes than large diameter bolts.

An analysis of staybolt action would indicate that they do not break from direct or tensile load, the liberal factors of safety used would indicate that, and therefore other stress must be the cause of staybolt breakages.

One cause of staybolt breakage is the movement of the firebox sheets in relation to the outside or wrapper sheets. There is no doubt that the movement is considerable, due to the different conditions affecting the sheets. The outer sheet is exposed to the atmosphere and to the water temperature, the inner sheet to the water and fire temperatures, and these are modified in turn by mud and scale to the serious disadvantage of the firebox sheet, hindering its conductivity of heat to the water and causing a higher degree of expansion and subsequent contraction.

These movements of the sheets give the staybolts an angular or lateral pull and are most severe when there are the greatest temperature differences in the firebox.

These extreme differences occur in hasty firing up, cooling down, cold water washing or filling, and from cold drafts after the fire is knocked out. When the boiler is in normal operation, it is doubtful if the angular stresses are excessive and it is probable that the initial rupture, the first start of the breakage, occurs at some firing up time or other period of extreme temperature variation.

Staybolts break under the pull due to pressure, but only after the cross-section has been reduced by checking, a partial fracture induced by over-stressing the outer fiber of the staybolt at times of extreme movements.

The larger the bolt beyond actual requirements the more probability of its early failure, for the obvious reason that the stiffness and rigidity increases with the size, and large bolts are unable to respond to the firebox movements very many times before the fracture starts which ends with a broken bolt.

Almost invariably solid bolts break close to the outer sheets and due to this, the practice of drilling a telltale hole in the outer end gives warning of a broken or fractured bolt. The reason for the location of breakage is because the outer sheet is always heavier than the inner, is not as subject to movement and acts as a foundation for the staybolt, the other end of which is pulled laterally by the firebox movement.

Flexibility consistent with strength is a desirable and necessary feature in determining staybolt diameters; increase of size and strength decrease the element of flexibility upon which the life of the staybolt depends.

The Watchdog of the Diesel-Electric Locomotive

Proper protection against damage from grounds and flashovers is a necessity in locomotive operation. Application principles and functions of the ground relay are here discussed

By G. R. McDonald*

THE watchdog of a diesel-electric locomotive is the ground relay. It is always on the job watching for failure of the electrical equipment. A surprising number of features come under its jurisdiction. The relay itself is a simple device, with its coil connected between ground and some point on the power system. The things it does, cover a wide range of subjects which should be of interest to anyone using and applying this type of control. The following discussion will serve to illustrate some of the application problems and other features of this type of relay.

This relay detects grounds and/or flashovers, relieves the situation by removing generator field excitation and making appropriate changes in the control circuit. Along with this, a warning indication is given to the engineer that something has gone wrong with the equipment.

This discussion applies to an Alco-G.E. road locomotive. The ground relay considered has a pickup of 38 volts with a coil current of .056 amp. The coil resistance is 680 ohms.

Armature Grounds

Assume a low-resistance ground on a main generator armature as indicated in Fig. 1 (a). The generator is carrying load and the remainder of the power circuits are well insulated. The point of ground relay connection to the power circuit will be slightly positive with respect to the generator negative brush due to the drop through the commutating field. When the ground is in the immediate vicinity of the negative brush, the current through the relay will be in one direction. As it moves away from this point, the current in the relay will reverse. The maximum voltage will be applied to the relay when the ground is in the vicinity of a positive brush. Fig. 1 (b) illustrates this wave shape. Neglecting the slight amount of reversal when the ground is near the negative brush, it will be seen that the relay has an undulating d.c. voltage applied to it.

Two things affect the pickup of the relay under these conditions; the speed of the generator and the load on the generator.

Fig. 1 (c) shows the effect of speed or frequency on the pickup of the relay with no load on the generator. The plot covers the range from idle speed of the engine up to full rated speed.

Fig. 1 (d) shows the second variable; the amount of load on the generator. The drop through the generator commutating field causes a reduction in the effective voltage applied to the relay coil. The higher the generator load, the higher the armature voltage required to produce relay operation. The curve shows the range from zero up to a maximum load corresponding to series operation at approximately 30 per cent adhesion.

With a low-resistance armature ground, neither of the above variables is enough to prevent operation of the 38-volt relay at comparatively low generator voltage. If the ground has appreciable resistance, the relay pickup will be raised. With a coil which operates on .056 amp., the increase in generator voltage will be small as compared to a relay requiring a higher pickup current. Low pickup current is, therefore, of advantage in giving prompt indication of trouble and limiting the amount of damage to the armature insulation.

The effects of motor armature grounds on the ground relay are similar to those described for the generator. In each case, undulating voltage is produced, and to this must be added the voltage of the motor armature position in the circuit. For instance, if two motors were operating in series and a ground occurred on the motor armature connected to the positive side of the generator, the undulating voltage applied to the relay would then vary from approximately half, up to full generator voltage. This is a more favorable condition to produce relay operation than that described for the generator. If the ground took place on the negative motor armature, the undulating voltage would vary from about zero up to half the generator voltage. For motors connected in parallel the undulating voltage applied to the relay will vary in much the same manner as that described for the generator.

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Power Circuit Grounds

Power circuit grounds may be divided into two types: (a) accidental grounds involving one or more points of the power system, and (b) general leakage grounds such as might be caused by moisture condensation or other extreme moisture coiditions.

(a) Accidental power circuit grounds may take place on cables, motors, generators or other apparatus in the circuits. Under all of these conditions, the amount of d.c. voltage applied to the relay will depend upon the generator voltage and position of the ground in the power circuit. Whenever the point of grounding is positive, by 38 volts or more, with respect to the point where the ground relay connects to the power circuits, as illustrated in Fig 2 (a), the operation of the ground relay requires no further comment.

A ground on the negative leads *a* in Fig. 2 (a) has a tendency to short circuit the relay coil and there will not be sufficient voltage difference to operate the relay. If a second ground occurs on the positive side *d*, current will be supplied to the ground on *a* and to the ground relay in parallel. Depending on the magnitude of the ground current and the resistance of the ground on *a*, the relay may or may not give indication.

If the ground occurs on lines *b* or *c*, the relay has a better chance of operating. The steady-state drop through a motor series field will not be enough to accomplish this, but during transient conditions, the "kick" in the motor field will operate the relay.

This siuation might be improved by using a lower resistance coil for the relay or by changing the relay connections. The lower resistance coil has objections from other standpoints. Two changes in connections appear to be possible.

The most apparent scheme would be to use a potentiometer connecting the relay coil to the system part way between generator positive and negative. This could be done to insure relay operation on positive and negative grounds. It could also be so located as to protect the leads operating at half generator potential during series operation.

Another way of improving this situation would be to change the relay connection from *a* to *e* in Fig. 2 (a). With a ground on *a*, the relay would be subjected to transient voltages developed in the generator commutating field. With grounds on *b* or *c*, the relay would be subjected to the sum of the transient voltages of the generator commutating field and the motor field involved.

(b) The resistance between the positive and negative circuits of a locomotive and ground may be materially reduced by moisture condensation or heavy rain conditions. There are more connections made on the negative than on the positive side of locomotive power system. If leakage due to moisture is generally distributed throughout the locomotive, then the resistance from the positive circuits to ground will be higher than from the negative circuits to ground. This is illustrated by Fig. 2 (b), for the parallel connection, in which all of the leakage resistors indicated are supposed to be of the same

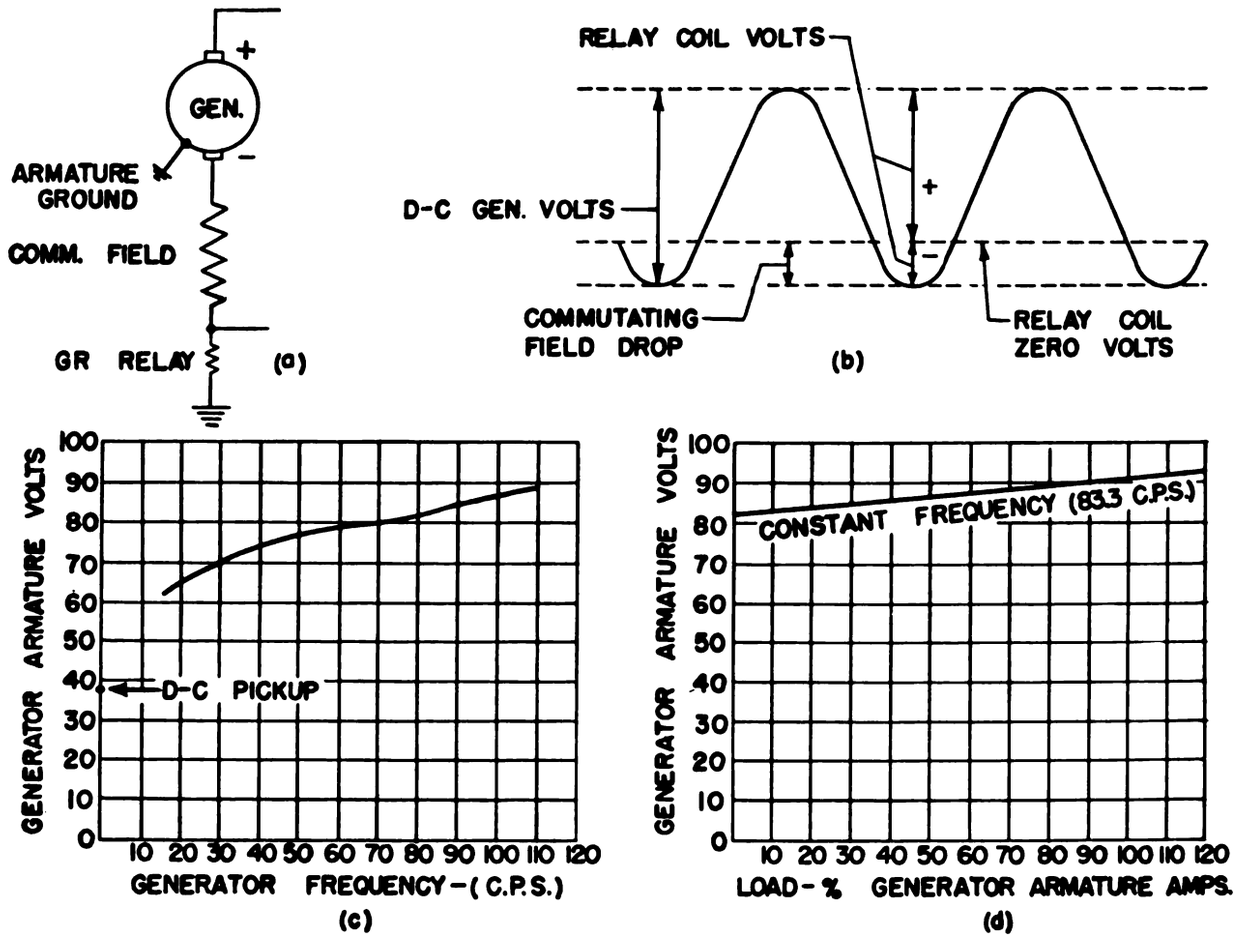


Fig. 1—Pickup of ground relay with generator armature and shaft securely grounded

values. This figure can be converted into the circuit of Fig. 2 (c). Using this circuit and assigning various ratios between positive and negative, the family of curves indicated by Fig. 2 (d) may be constructed. For instance, curve *C* indicates the conditions for operating the ground relay if the leakage resistance from the positive side of the system to ground is twice the leakage resistance of the negative side to ground. This set of curves has been plotted on log-log scale to separate the various curves for the sake of legibility. With the conditions of curve *C*, if the leakage current is high (resistance value low) ground relay operation takes place when the generator reaches 114.4 volts. If the leakage currents were initially low (high resistance values), then considerably higher generator voltage could be used. With motors connected in series, the permissible operating voltage of the generator appears to be slightly lower than illustrated by Fig. 2 (d), but the general shape of the curves is the same.

The process of drying up moisture leakage grounds is quite interesting. Fig. 2 (c) shows that the generator leakage current flows through the positive leakage resistance; then, in parallel, through the negative leakage resistance and ground relay coil. If the leakage resistance of the positive is higher than the negative, the watts loss between positive and ground is much higher than between negative and ground. The rate of drying will be faster on the positive and the ratio between the two resistances will increase as the drying proceeds. If the resistance of the moisture film is lowered by dirt, the rate of drying will be increased. If moisture conditions are suspected to be present, the locomotive throttle should be notched up slowly to permit drying the surfaces without reaching voltages high enough to cause tracking and permanent damage to the surface of the insulation. An excellent article on this subject is A.I.E.E. Technical Paper 51-123, "Factors Affecting Minimum Surface Leakage Distance in D.C. Power Systems," by Hart, Rosenberry and McClinton.

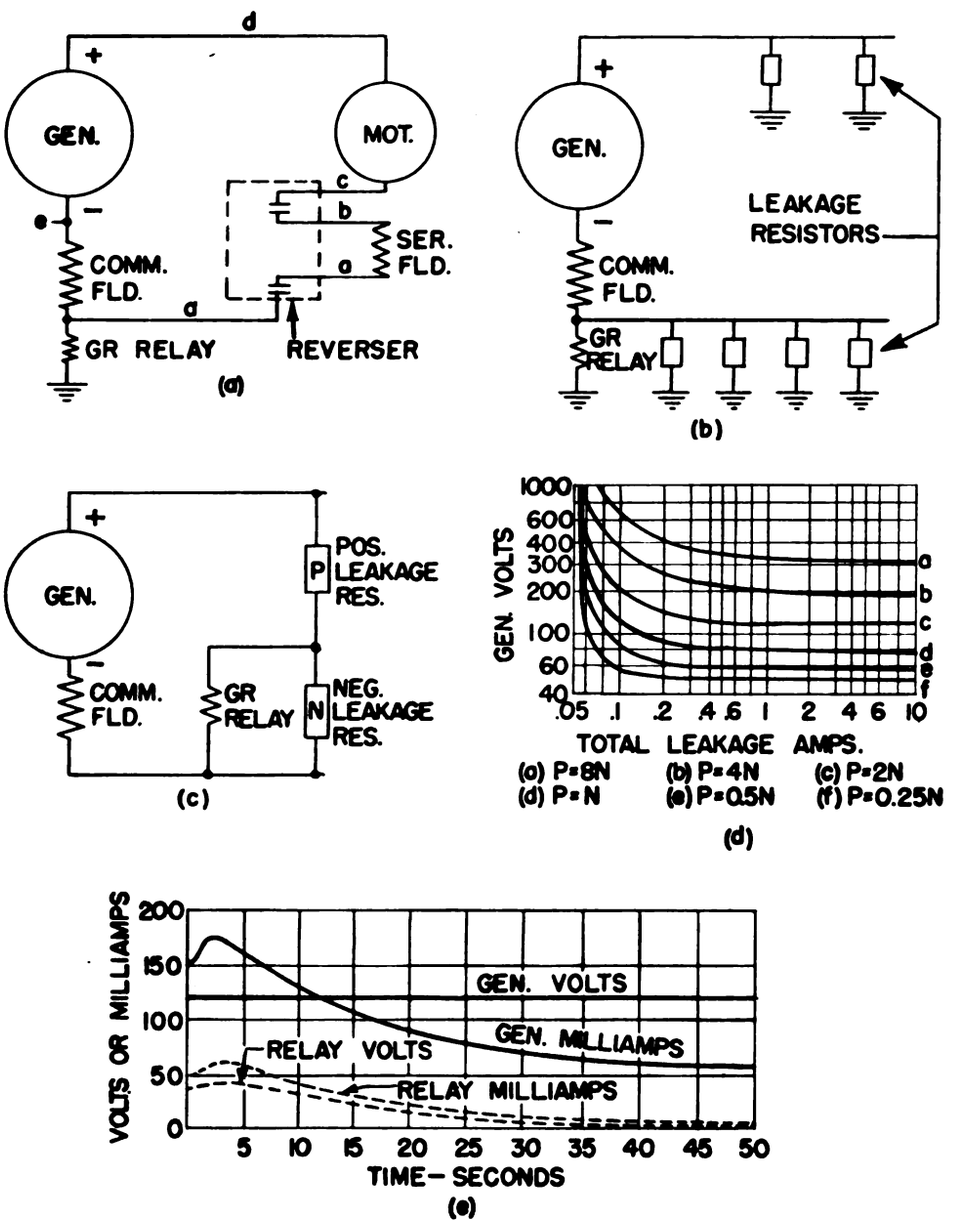


Fig. 2—Relay operation with power circuit grounds

Fig. 2 (e) is plotted from an oscillogram taken to illustrate the drying procedure, using the circuit of Fig. 2 (c). Leaage films were obtained by using water over an insulating paint. The positive film was arranged to have the cross section and the same length as the negative film. Hence, the positive may be assumed as starting with twice the resistance of the negative. The generator voltage was adjusted to give approximately relay pickup voltage at the start of the run and was held constant until the positive film dried.

Electric Osmosis*

Whenever cable is used in the presence of moisture and the conductor of the cable is negative with respect to grounded moisture on the outside of the insulation, electric osmosis tends to cause moisture to fill the pores in the cable insulation and cause a failure. Such cable is supposed to be more prone to failure than it would be if the conductor were positive with respect to ground. Actual experience seems to indicate that there is not too much difference in the operation of power systems between grounding the positive and grounding the negative. However, this could be taken as an indication that it would be preferable to ground the negative.

Commutator Flashovers

Flashovers may take place on the commutator of a traction generator or a traction motor. A discussion of the generator flashover should serve to bring out a number of the points involved and make it unnecessary to discuss motor flashover in similar detail.

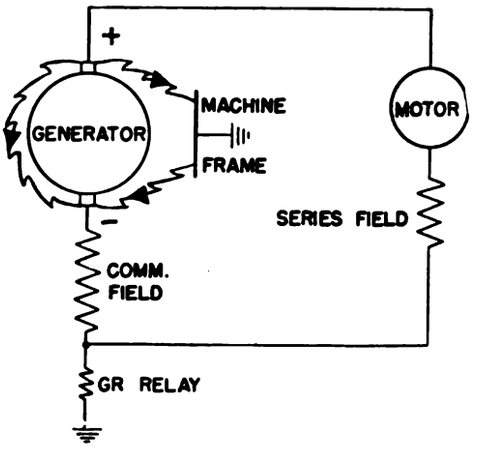


Fig. 3—Generator flashover

Fig. 3 indicates that flashover arcs may be regarded as going from brush to brush, and also from positive brush to ground and from ground back to the negative brush. Where the current leaves the positive brush to go to ground, there will be an anode drop. Where the current goes to ground, there will be a cathode drop. Where the current leaves ground and goes to the negative brush, there will be corresponding anode and cathode drops. This would indicate that ground potential

* Electrical Engineers' Handbook, Third Edition, Volume IV, by Pender and DelMar, Section 6, page 25, paragraph 15.

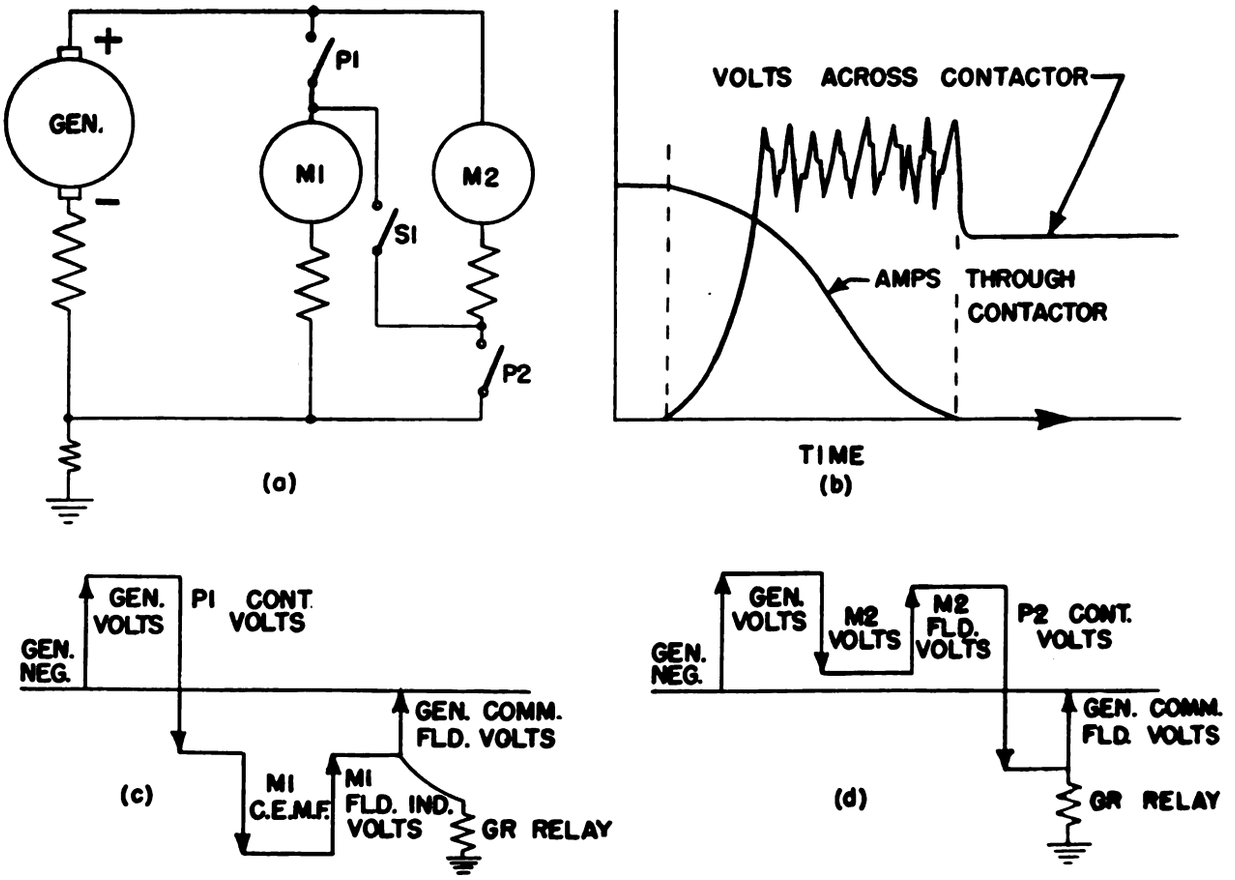


Fig. 4—Power contactor diagrams

should be approximately half way between the potential of the positive and negative brushes. During a flashover, the voltage across the brushes of the generator will be reduced somewhat and will be quite variable. Oscillographic records show that there is still a voltage of considerable magnitude; and as half of this voltage is available for the operation of the relay, no difficulty has been experienced in practice in having a negative-connected ground relay operate during a generator flashover.

Using a ground relay connected to one of the machine polarities provides positive operation. If the relay were connected to a potentiometer dividing the voltage across the generator there would be less voltage applied to the relay coil. Other potentiometer connections may be considered, but do not appear to afford good protection for flashovers of motors connected in series.

Power Contactor Flashovers

Fig. 4 (a) shows a simplified diagram of the power circuits of a locomotive, with the location of the power contactors. The space available for control apparatus in a locomotive is normally cut to a minimum, consequently, switching devices are closely spaced and little room is permitted for arcing. Normally little trouble is experienced due to flashovers of these power switching devices; however, under extraordinary conditions it is possible to have arcs from the contactors reach grounded metalwork.

The distribution of voltage and current in a contactor during current interruption is shown by Fig. 4 (b). As the contactor starts to open, voltage appears across its contacts; and as the contacts separate more fully and the arc is lengthened, this voltage builds up to comparatively high values. After the interruption is complete, generator voltage will appear across the contacts. Contactor operation also causes rapid changes of the power circuit currents. At such times inductive voltages ("kicks") are generated in the field circuits.

Assume that during opening the arc of contactor *P1* goes to ground. Fig. 4 (c) shows a probable voltage distribution around the complete circuit made up of the generator, contactor *P1* and motor *1*. The voltages are represented by vertical vectors. The horizontal lines have no significance but are used as a means of separating the various voltage components. Generator voltage is assumed as starting at the negative brush. The voltage across the contactor *P1* is assumed at the time when maximum voltage is being generated across this contactor. This is followed by the motor counter *EMF*, motor field voltage and the generator commutating field voltage. The position of the ground relay is indicated on this sketch also. Obviously, the ground voltage due to the arc must fall about midway along the vector representing the voltage across the contactor. The voltage difference between the arcing ground and the point of ground relay connection to the circuit may be estimated. It appears to be sufficient to give reliable operation of the ground relay. The voltage across the contactor will be of a highly fluctuating nature. This means that the voltage applied to the relay will also be fluctuating.

Fig. 4 (d) shows a corresponding plot for the case of a flashover on contactor *P2*. At first glance, it might be assumed that this contactor, being connected to the negative side of the line, would never develop enough difference in voltage during a flashover to operate the ground relay. Actually, the chance of operating the ground relay is just as good as in the case of a *P1* flashover.

A similar figure might be drawn for the series contactor *S1*.

A bridge connection for the ground relay, which would place its coil midway on generator voltage, would seem to give less reliable operation in the case of a *P1* flashover and more positive operation in the case of a flashover of *P2*.

Dynamic Braking

In Fig. 5, it will be noted that the generator supplies excitation to the motor field circuits which, in turn,

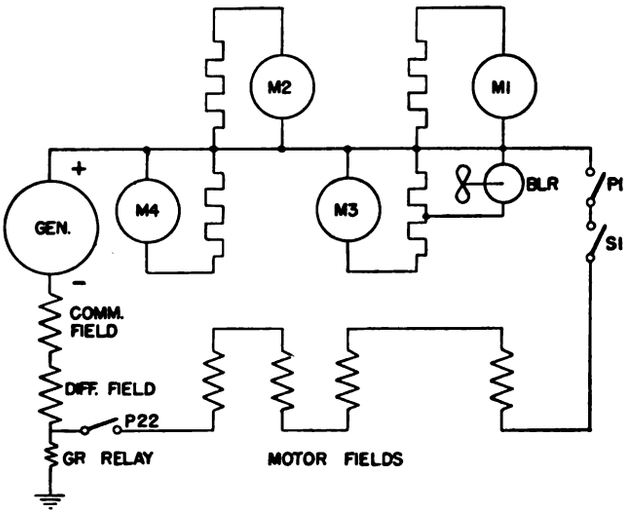


Fig. 5—Dynamic braking connections

excite the motor armatures. The armatures are arranged to feed into braking resistors. A small part of this waste power is used to operate a blower tapped across part of one of the resistors. Resistors and armatures are represented as being above or below the line connected to the generator positive to illustrate the direction taken by the voltages developed during braking.

The voltage applied to the motor fields for excitation during braking is quite low. A ground on one of these fields would not produce enough voltage difference to cause operation of the ground relay as long as steady-state conditions exist. However, any rapid change of motor-field current would result in inductive voltages which, depending on the location of the ground, have a chance of operating the ground relay.

A ground in a motor armature would cause an undulating d.c. voltage to be applied to the ground relay as discussed in connection with generator and motor armature grounds. The same comment applies to the armature of the blower motor used for cooling the grids.

A traction or blower motor flashover will produce ground potential which is fluctuating in character and will give sufficient voltage difference to operate the ground relay.

A ground on the dynamic braking resistor elements may or may not produce sufficient voltage to operate the relay. No operation would be expected if the ground is near the common connection from the generator. If the ground location departs considerably from this point towards the outer end of the resistor, sufficient potential will be produced to provide prompt relay action.

It is obvious that any motor armature ground or a fault in the braking resistors would require the opening of contactor "P22" to remove motor field excitation.

Ground relay protection is not usually furnished for control circuits and other auxiliary equipment, such as motor blowers. The battery is connected to the power circuits whenever the diesel engine is started. At this time, a ground on the control circuits or on the battery may affect the ground relay.

Batteries are a common source of grounds and there is some difference of opinion as to whether this type of ground should be permitted to interfere with locomotive operation. If the relay pickup voltage is low, it would tend to operate on most battery grounds. If the pickup of the relay were higher than the open-circuit voltage of the battery, it would never indicate a battery ground. A relay with 38-volt pickup represents a compromise between these two extremes.

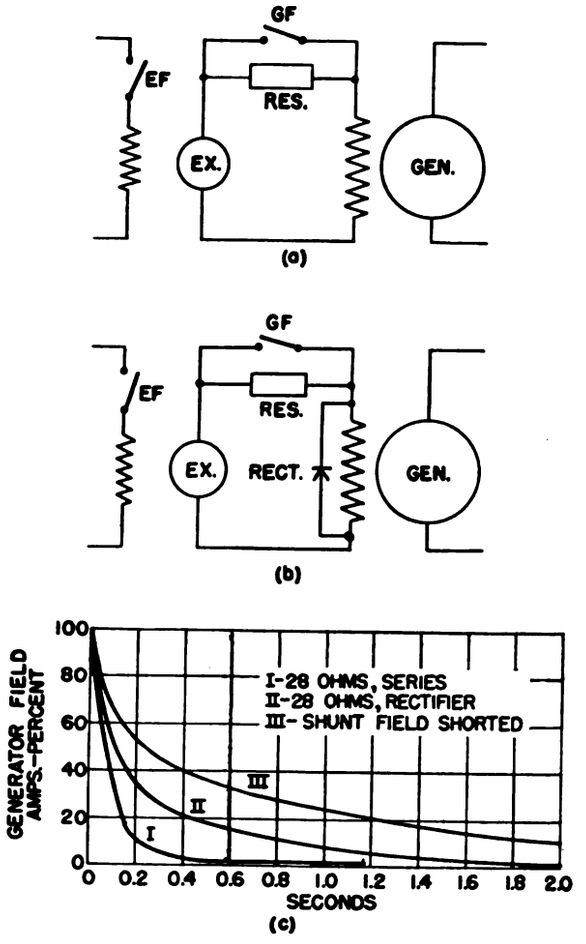


Fig. 6—Generator field excitation circuits applied to a machine having a two-ohm shunt field

The potential applied to a ground relay by a battery ground varies during the starting cycle. At the initial rush of current, most of the drop in the circuit will be in the series and commutating fields of the generator and the armature drop will be low. The relay will act as though it were connected in the circuit toward the positive side of the battery and will operate on grounds located toward the negative end of the battery. A relay fast enough to work at different points during these transient conditions will tend to check the battery from end to end.

Ground Relay Functions

Operation of the ground relay simultaneously opens the generator field contactor and exciter field relay, energizes a signal light, reduces the engine speed to idle, and opens the motor field excitation circuits if the equipment is in dynamic braking.

There are many operations of the ground relay which require high-speed response in order to minimize damage to the equipment. High-speed response is secured in several ways. The relay is a small, fast-operating mechanism and the devices which are used to perform auxiliary functions are as small and fast in operation as possible.

One of the main protective functions is the reduction of the generator field current to reduce generator voltage. The generator is provided with a low-voltage shunt field. It is, therefore, possible to arrange the generator field contactor to insert a large amount of resistance in the field circuit without producing voltages which would break down the field or circuit wiring. Common practice with Alco-G.E. road locomotives is to use a resistor having approximately 14 times the field resistance. The voltage across this resistor will momentarily be some ten times the voltage normally applied to the field. Another reason that this generator permits high-speed field reduction is the fact that there are no other closed-circuit windings on the field poles. Any other windings which form a complete circuit, regardless of the path of the circuit, would, by transformer action, slow up the reduction of generator voltage.

Fig. 6 (a) illustrates the circuit normally used with Alco-G.E. road locomotives. Both *EF* and *GF* are opened by operation of the ground relay. The decrease in generator field current, plotted against time, is shown by Fig. 6 (c), curve I. If *EF* only were opened, the field current would die down slowly as indicated by Curve III. To ease the duty on contacts in the field circuit and limit the inductive voltage of the field, a rectifier is sometimes used, Fig. 6 (b), to provide a discharge path. The rate of field current decrease thus obtained is shown by Curve II.

The generator voltage decrease would follow the shape of the field current curves, if the speed were held constant. During the time the field current is being reduced, the generator speed is also being reduced to idle, so the change in generator voltage will be faster than indicated by Fig. 6 (c). This is an important follow-up consideration.

General Considerations

An inspection of the foregoing considerations in connection with the application of a ground relay reveals very few points where the operating current or voltage of the relay could be considered at all critical. These are in connection with power-circuit grounds, power-circuit leakage grounds and dynamic-braking-equipment grounds.

In connection with power-circuit grounds, it was noted that a ground on one of the negative leads could short-circuit the coil of the ground relay. A very low-resistance coil for the ground relay would give better protection at this point. Such a coil would, on the other hand, produce other difficulties in that comparatively high current would be required for the operation of the relay. This would permit high current inrushes with greater damage from fault currents.

Fig. 2 (d) shows that, during general leakage conditions, only a part of the leakage current passes through the relay coil. Actually, the amount of leakage current is

relatively unimportant. The relay, in this case, serves as a means of preventing high-voltage operation of the traction generator. Thus it tends to prevent tracking during the drying period, which would cause permanent damage to the insulation.

Dynamic brake equipment uses a large amount of Transite to provide high-temperature insulation. Transite tends to absorb moisture and consequently, may have comparatively low resistance to ground. The braking resistor losses will dry the equipment rapidly without any danger of tracking or causing other damage. In this case, a higher current ground relay might be an advantage.

Ground-Relay Connections

Grounding the negative of a traction generator appears to be somewhat better than grounding the positive. This is normally accomplished by connecting the grounding relay to the outgoing lead from the generator. This practice appears to give good operating results. It would, however, be possible to ground the negative brush of the traction generator, thus getting on the other side of the commutating field. As discussed above, this would provide a small amount of additional protection against accidental grounds on the negative power cables.

Another means of connecting the relay would be to provide a potentiometer connection from the generator negative to positive, and connect the relay to this potentiometer. This has the disadvantage that operation on generator, motor and contactor flashovers would not be as reliable.

As a last resort in stopping a locomotive with inoperative brakes, plugging may be used. The consequences to the rotating equipment may be quite severe. Flashovers of the motors and generator are liable to take place. These would operate the ground relay and remove the generator excitation. This, however, does not affect the ability to maintain the plugging condition. The series motors act as generators and no source of potential from the generator is necessary, although the generator armature may carry the plugging current. The ground relay, is arranged so that it does not in any way interfere with obtaining plugging in emergencies.

Operation Without Ground Relays

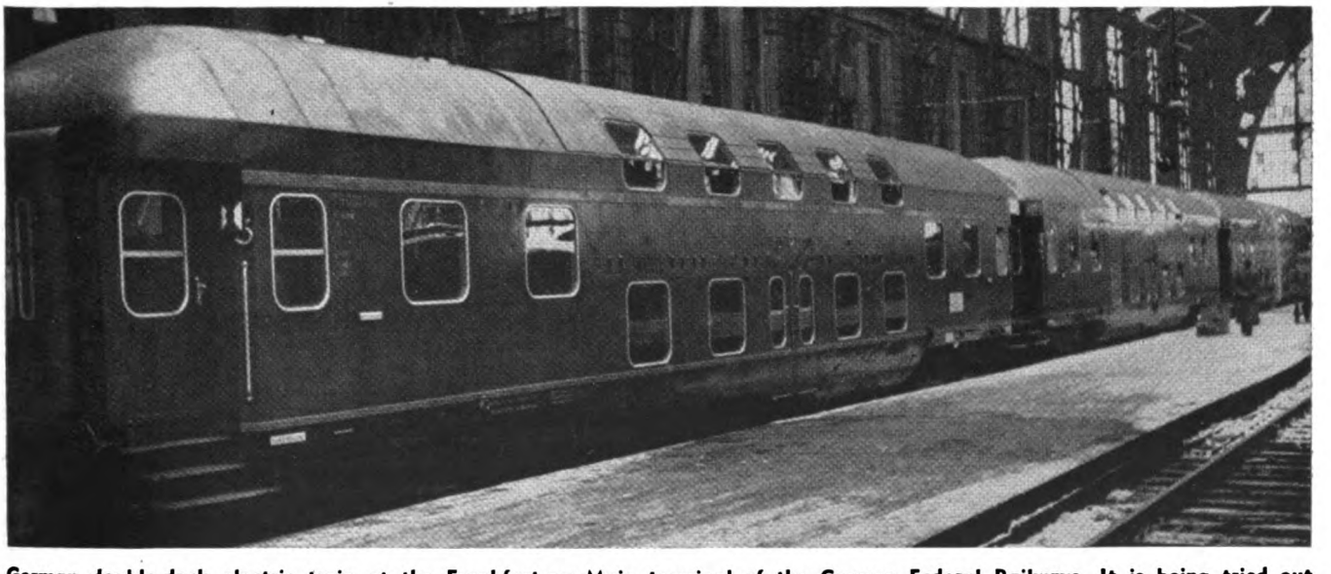
With all ground-relay systems, it is customary to provide a cutout switch in series with the relay coil. This may be opened in case of a ground on the system or other emergency which tends to operate the relay and prevent movement of the locomotive. The ground relay should never be cut out except for an emergency condition where it is absolutely necessary to have the power of the locomotive in order to clear a track.

All of the protective features discussed above are sacrificed when this relay is cut out. Probably the most serious of these is protection against flashovers. There have been cases of operation with the ground relay cut out, where flashovers have taken place which did not clear themselves and continued long enough to cause serious damage to the equipment.

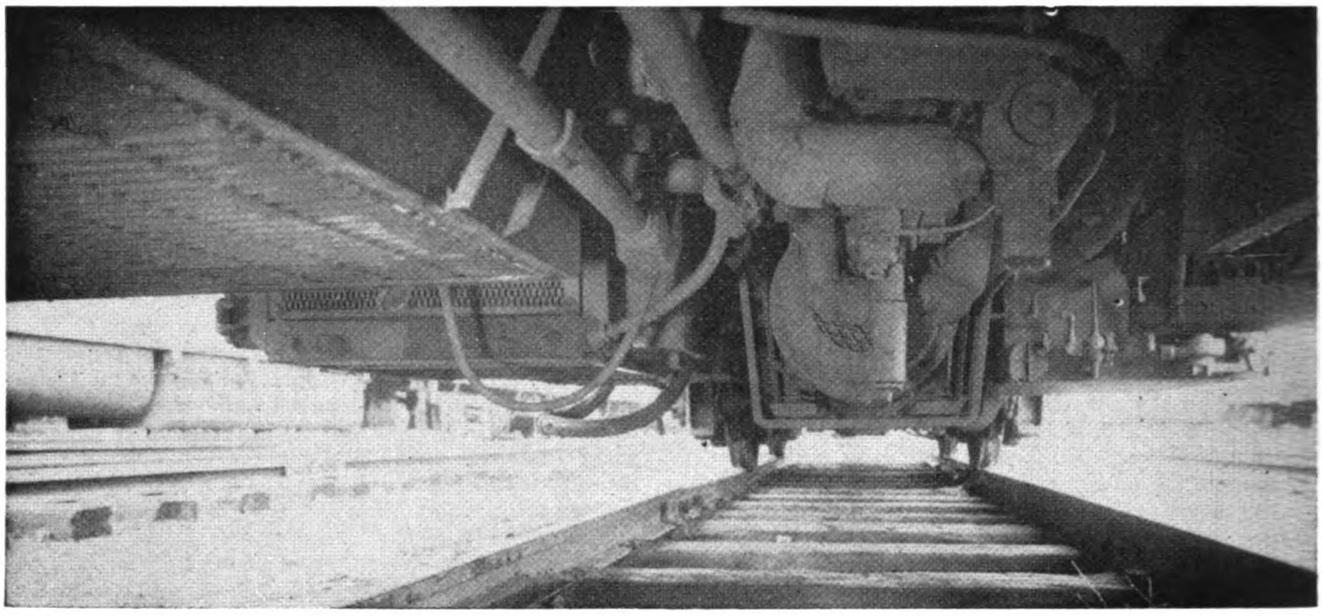
It is common practice to use the traction generator to check on engine horsepower, generator characteristics, etc. To do this, the generator is disconnected from the traction-motor circuits and connected to an artificial load. When making such tests, it is always advisable to be sure that the ground relay connections are not interfered with, and that this relay is fully operative to take care of any unexpected difficulty which might arise during the progress of the test.

The above discussion covers a number of features in connection with ground relay operation and application. It is believed that the discussion indicates the importance of this relay and some of its complexities. The discussion has been based on Alco-G.E. road locomotives, with no attempt to deviate far from this particular application. Undoubtedly, further study and experiment on the subject would result in improvements in this application. However, the system described has been in service for a good many years, and has provided a highly practical and successful degree of protection for locomotive equipment.

Authenticated News Photo



German double-deck electric train at the Frankfurt-am-Main terminal of the German Federal Railways. It is being tried out on the 212-mile Frankfurt-Cologne-Dortmund run and consists of three two-story cars, with a dining room in the upper deck of one of them and a seating capacity of 300 persons. The train weighs 110 metric tons (242,000 lb.)



View under the car showing the amplidyne inverter suspended from the center sill and the Enginator in operating position at the left

Axle and Engine Power for Buffet Car

D. & R. G. W. meets requirements of increased load by adding Enginator to car equipped with axle generator

THE Denver & Rio Grande Western recently obtained several buffet-lounge cars, and provided additional cooking facilities in buffet, thereby increasing the connected electrical load from 27 to 38 kw. The cars operate between Denver, Colo., and Grand Junction, Colo., on the "Royal Gorge" trains. In their new capacity, the cars are used to supply short order meals, bar service, and all lunch counter requirements.



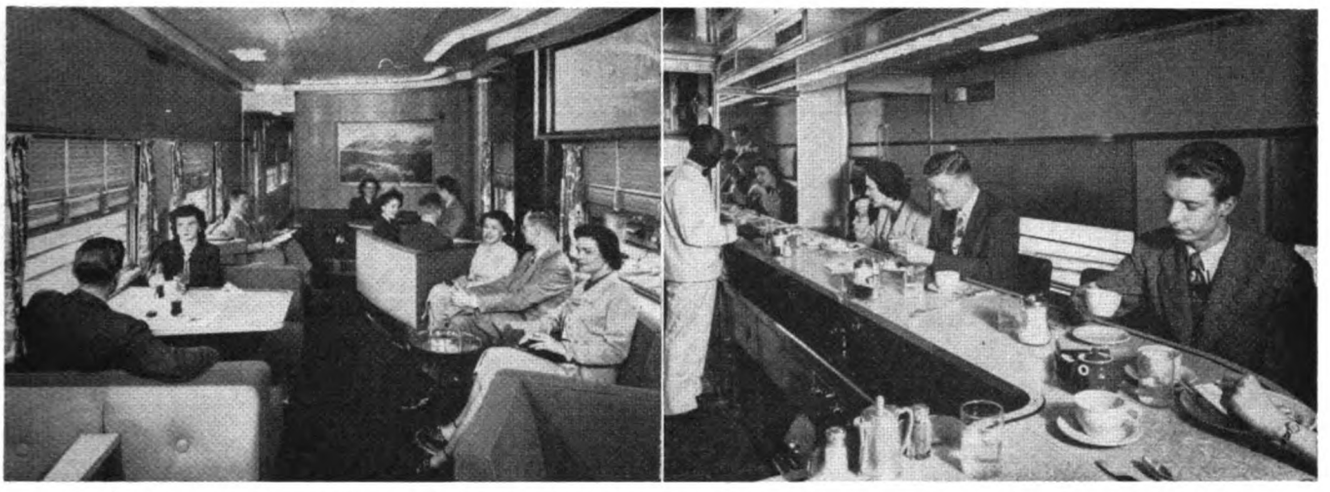
Two hot plates and a griddle make up a major part of the added load

Originally the car was equipped with a General Electric, G.M.G. 150-A-3, 30-35 kw. axle-driven, motor-generator, and a 1,080 amp.-hr., 37-plate, 32-cell lead battery. A 6½ kva. amplidyne inverter supplies 110-volt, 3-phase, a.c. power. To meet the added load requirements, a 7½-kw. Waukesha Enginator was mounted under the car.

Regulated voltage (61 volts d.c.), provided by a safety lamp regulator, is used for incandescent lights, door engines and wheel slide control, the connected load being 1,207 watts.

The amplidyne inverter supplies 110-volt a.c. power to fluorescent lights, exhaust fans, juice extractor and the Rotoclone air cleaner. Input to the inverter is 5,000 watts.

In the original installation, unregulated d.c. power was used for the air-conditioning compressor, (Frigidaire 8-ton), condenser fan, condenser pump, blower motor, two-slice toaster, a four-burner Silex, three compressors which serve three refrigerators and one low-temperature box, and the air brake control. This load was 20,223 watts which, with 5,000 watts for the inverter, 1,207 regulated watts, and 515 watts, regulator loss, made a total connected load on the car of 26,945 watts, approximately 27 kw.



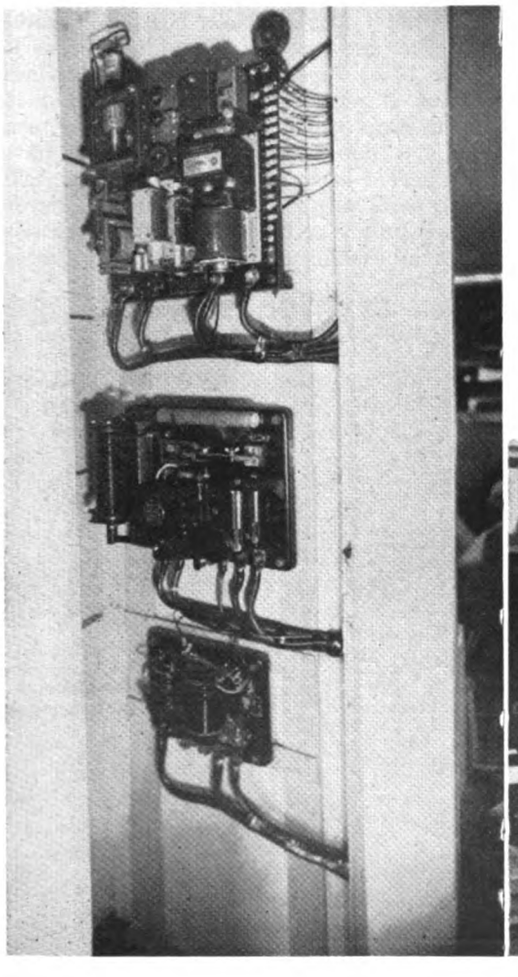
Left: Lounge section of the car. Right: The lunch counter provides short-order meals and lunch counter service

When the car was given the new service requirements, two hot plates, a griddle, two toasters and two drink mixers were added, making the total connected load 38 kw.

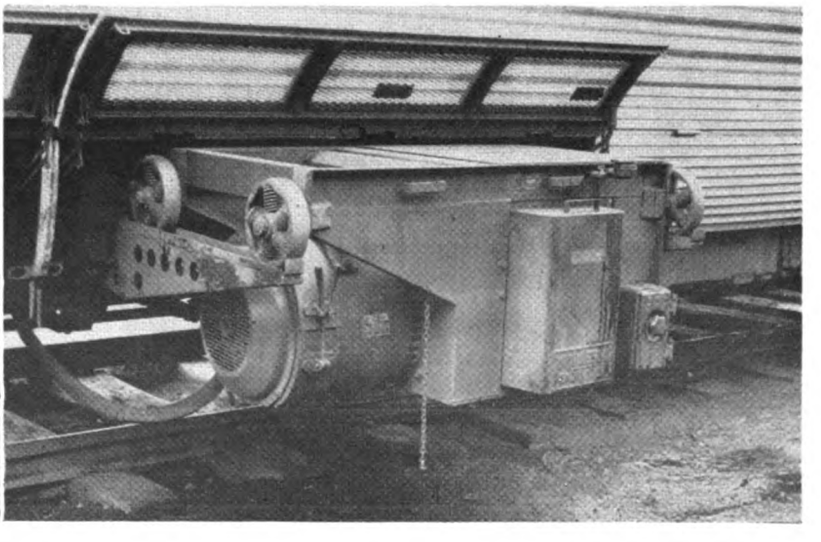
The Enginator is started manually from a pushbutton station in the car. When the axle generator voltage rises to about 45 volts, a relay disconnects the Enginator and shuts it down. This, of course, also happens when wayside standby power is used to drive the axle generator.

The service requires this particular car to lay over for three hours at Grand Junction, Colo. There is no standby service at this point, and the Enginator is used during the layover to insure starting the run with a full battery. It is also used during the run when the axle generator is not supplying power, and at the Denver terminal. Plans have been made for automatic starting as well as stopping of the Enginator, if operating conditions make it desirable.

Space is always at a premium on cars of this kind and to find a suitable place for the Enginator, where it could be rolled out for inspection and servicing, the Enginator was put in the place of the condenser and compressor control. The amplidyne inverter, under one side of the car was replaced by the condenser and compressor control, and the inverter was then suspended from the center sill. About eight inches end clearance is necessary to provide for application or removal of the inverter from the center sill. Space for the Enginator fuel tanks was obtained by moving two air reservoirs longitudinally a distance of about five inches.



Left: A broom closet provides space for the Enginator controls. Below: The Enginator rolled out on ways for servicing



DIESEL-ELECTRICS—How to Keep 'Em Rolling

3 Lubrication of Roller Bearings and Gears*

There are a few lubrication musts and a lot of don'ts in getting long trouble-free operation out of gears and bearings

THE AGE old sleeve type bearing is familiar to all of us. We have already seen that in this design the oil has the job of keeping the journal from touching the bearing.

Roller and Ball Bearings

HOW THEY WORK.—In the newer ball and roller type bearings, the lubricant still has to work with a sleeve bearing. You will see this if you think of a roller or ball bearing as being a series of wheels rolling between two tracks, (the inner and outer races). These wheels also roll in sleeve bearings, (the cage). If you could cut the inner and outer races of a roller bearing and lay them out flat like Fig. 1, that's exactly what you would have. Here the lubricant has an easier job than in the regular sleeve bearing because it does not have to support the load. It serves to keep the cage from touching the rollers while the cage is keeping the rollers from bunching up. It also lubricates the thrust flanges of the races.

* This is the 3rd of a series of articles on maintenance of diesel-electrical equipment. This article is written by J. W. Teker and J. H. Kathman, both of Motor Engineering Division, General Electric Company, Erie, Pa.

There are many pitfalls in the lubrication and maintenance of roller and ball bearings. If you don't avoid them, they will surely cause some first rate trouble.

GREASE LUBRICATION.—The roller and ball bearings in many pieces of railway electrical apparatus are designed for grease lubrication. Actually this is the same as oil lubrication, since grease is made up of oil suspended in a form of soap. The soap holds the oil like a sponge, and releases it at the proper rate to lubricate the bearing. Grease is used because it is easy to keep in the bearing compartment.

WATCH THESE POINTS.—There are several things about grease and roller bearings that need careful watching.

1. If you think dirt is a trouble-maker in a sleeve bearing, listen to what it does to a roller bearing. It works in between the rollers and the cage. There it proceeds to ruin not one, but 14 or 20 or as many sleeve bearings as there are rollers. It gets in front of the rollers which pound it into the races causing a rough bearing and early failure. It gets into the grease and doesn't have the chance to settle out as in oil. Instead it stays right up in the moving parts where it can do the most harm. So whether or not you are godly, you have to be cleanly when it comes to lubricating and maintaining roller or ball bearings.

2. "And one for the pot" may work out fine when you are adding coffee to the percolator. It is no rule to

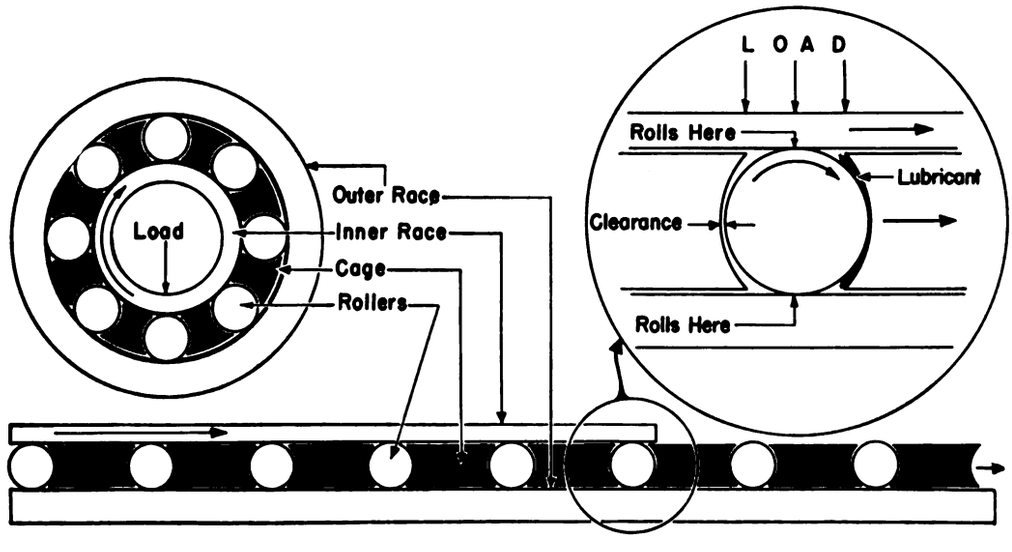


Fig. 1
Diagrammatic sketch of a roller bearing

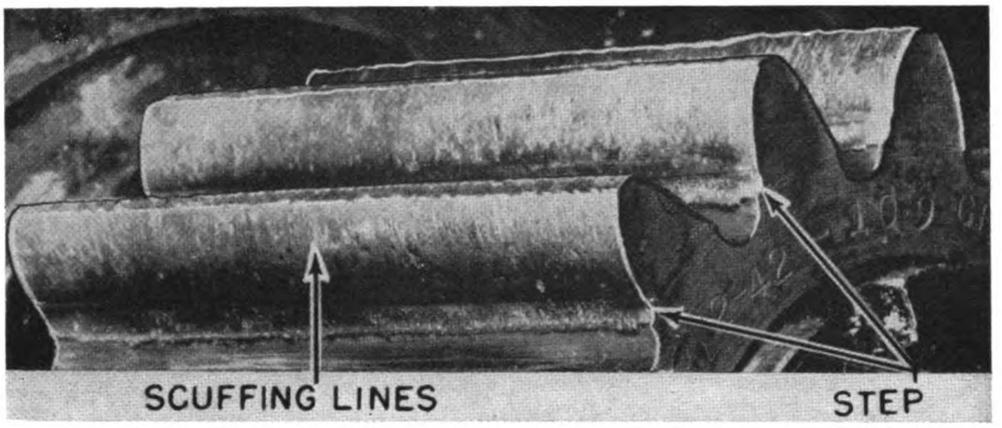


Fig. 2—Worn pinion showing step and scuffing lines on teeth

follow when adding grease to a roller bearing. That extra shot every lubrication period may easily cause a bearing failure. If the grease in a roller bearing is packed in so tightly that it cannot get out of the way, the rotating rollers and cage churn it. This heats up the grease, causing it to expand and make things worse. Finally, the grease gets so hot that it burns and can no longer lubricate the bearing, or the bearing gets so hot that it seizes. So, instead of a better cup of coffee, you end up with a costly repair bill.

3. Not enough grease in roller bearings is also a costly error. It can easily occur on bearings that require the addition of definite amounts of grease every week or so. This is specially true if the grease is added with a gun that squirts a shot every time a trigger is pressed. You probably figure that the gun squirts out a certain amount of grease every shot. This would be true if the gun were packed properly and in good operating condition. If, however, the cylinder is half full of grease and half full of air, the gun will squirt half shots. To stay out of trouble, it is a good idea to weigh the grease going into the gun. In this way, you can be sure it gets a full charge at each filling. Also, the weight of the shots should be checked frequently.

4. Another dangerous practice is mixing greases. If you start a bearing off with one kind of grease, continue with that grease until the bearing can be cleaned and refilled. If you mix a good grease with a poor one, the

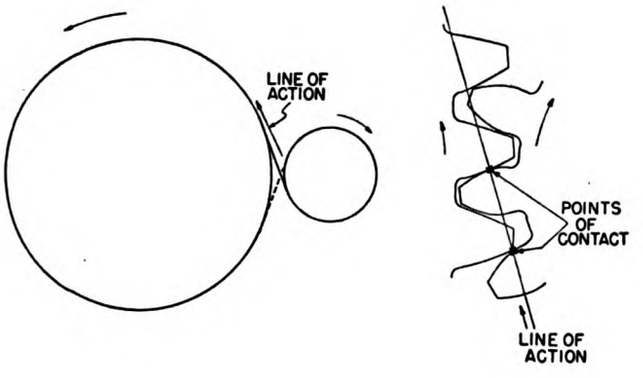


Fig. 3 — Analogy of gear and belt drives

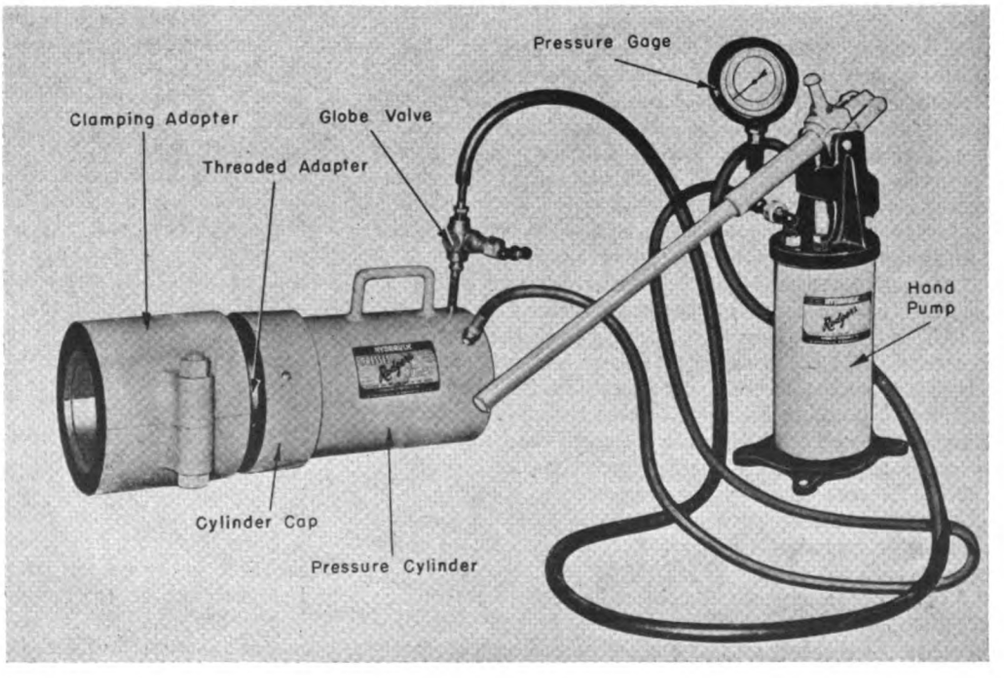


Fig. 4—Portable hydraulic pinion puller

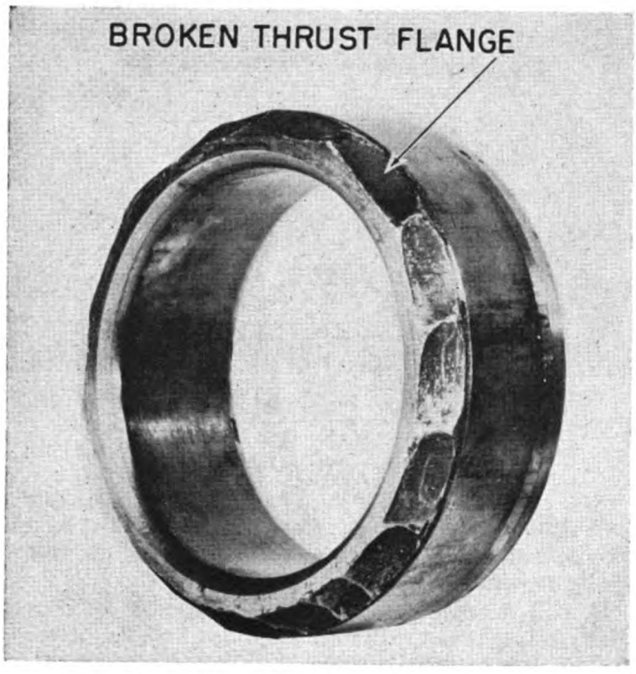


Fig. 5—Damaged bearing race resulting from the use of a sledge on the armature shaft

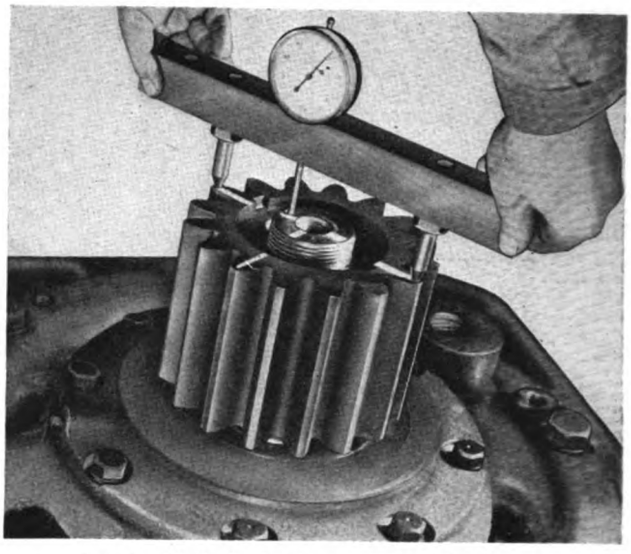


Fig. 6—Method of using a pinion advance gage

mixture will be no better than the poor grease. In addition, you may get into trouble because the two greases do not agree with each other chemically. Then, you will have a mixture that is worse than poor. It is especially important not to mix other greases with the high-stability greases used in sealed bearings.

5. If you could turn back the clock on any bearing failure, you would find that the bearing was hollering for help long before it failed. This gives the maintenance man a wonderful opportunity to catch bearings before they fail completely and damage the entire motor or generator. Listening rods are easily and cheaply made. With them you can readily hear all the moans and groans and clicking noises produced by bad bearings or rubbing seals. Sometimes it is quite difficult to tell a good bearing from a bad one. A good bearing always produces some cage and roller noises. Also, while you're listening, other noises caused by armature balance, gear operation, etc., creep in to complicate matters. Before you become an expert bearing listener you will undoubtedly tear down several machines and find the bearings in good shape. Don't let that discourage you. If you catch one bad bearing before it causes several thousand dollars damage, you will pay for a lot of teardowns.

OIL LUBRICATION.—Oil-lubricated roller and ball bearings also have their maintenance problems.

1. When the bearing is rotating at high speeds, it acts like an electric mixer as far as the oil is concerned. This causes the oil to form a foam which fills the entire compartment, searching for spots to seep through. Therefore, seals, plugs and gaskets must be accurately maintained in order to insure satisfactory operation.

2. Even with the best of maintenance, some oil will undoubtedly leak out, causing fire hazards and insulation troubles. Frequent cleaning is necessary to avoid these evils.

3. Bearing compartments in railway equipment are usually confined to small spaces and so have little oil capacity. As a result oil lost due to leakage and vaporization must be frequently replaced. This increases the possibility of getting dirt in the bearings. Here again, cleanliness is an important item.

The roller and ball bearings used in locomotive electric equipment are designed to give many thousands of hours of satisfactory operation. If a railroad is having a lot of roller bearing failures, a careful check should be made to see whether some of the above points are being overlooked.

Gears

The toughest job that Mr. Lubricant has is to keep gear teeth from chewing on each other. The oil in the sleeve and roller bearings must lubricate steel journals in bronze or babbit bearings. In a set of gears, it has to lubricate steel teeth sliding on each other. And do they ever slide!

A SPECIAL ASSIGNMENT.—Nearly everyone thinks that the teeth on gears are so shaped that they roll on each other. Actually that is true for only an instant. During most of the time that the teeth on the pinion are pushing the teeth on the gear, the surfaces of the teeth are sliding on each other. This sliding is under terrific pressure because of the power being transferred. The gear oil must stand up under this punishment. It must also manage to stick to the spinning teeth when the gears are rotating at high speed. To do this double job, the gear oil must contain a good quality oil and a substance to make it sticky. Just any old heavy oil won't work. Not all of the gear oils and compounds will work either. Some are so thick, they allow the gears to cut a groove in the compound, and then the gear teeth run dry. Some cannot stand the high temperatures in locomotive equipment, and soon become thick and hard. Some are too thin and break down under the heavy pressure. Even when you are using a good gear compound, you have to treat it right to keep it good. In many shops several steam pipes are run through the tank where the gear compound is kept, or a heating element is placed under the tank. This is done to heat the compound so it is easy to pour. The hotter the compound the easier it is to pour. So there is always the temptation to "turn on the heat." In the meantime, the compound back in the storage tank is cooking and loses some of its lighter substances. This means that it is heavier the next time it is used. If this

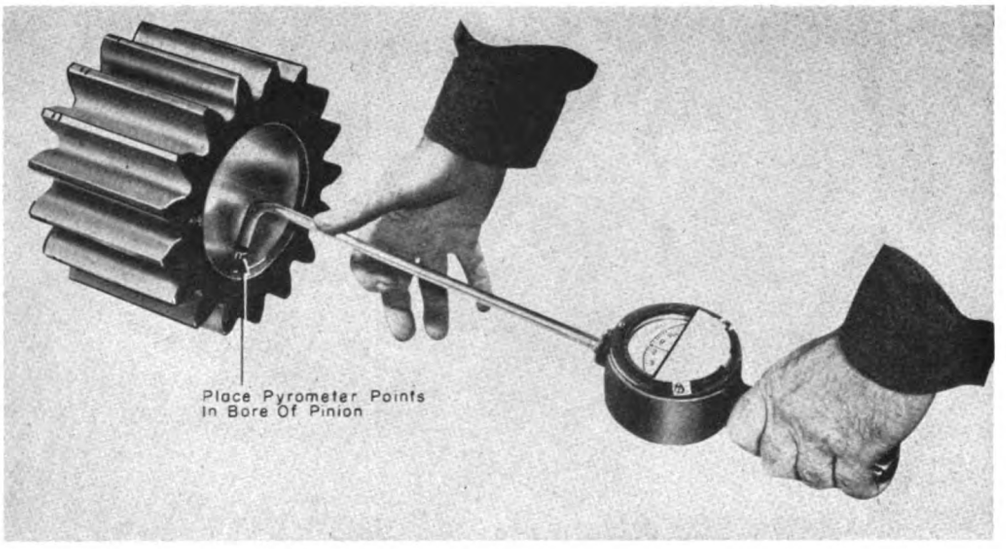


Fig. 7—Method of measuring temperature of a pinion with a pyrometer

process is repeated often enough, the compound will soon become unfit for use.

DANGER SPOTS.—It doesn't take long to ruin a good set of gears. An open cover or damaged seals can easily result in loss of lubricant or in dirt getting into the gear case. Either of these conditions will cause rapid wear of the gear teeth and quickly ruin a good set of gears. When gears wear, they develop a step at the root of the tooth, as shown in Fig. 2. This step causes interference troubles when a new pinion is matched with a worn gear. It also gives trouble when the distance between the centers of the gear and pinion is changed, as occurs with traction motors when the axle linings are replaced. All these things add up to early gear failures. By the way, failure does not necessarily occur only when the gears stop transferring power from one shaft to another. Gears fail when they stop transferring power smoothly. A set of badly worn or mismatched gears may operate for thousands of miles, but the trouble they can cause will cost thousands of dollars to repair. And that isn't a pipe dream either! Let's look at a pair of gears and see exactly what happens.

HOW GEARS WORK.—In a new set of traction motor gears, the teeth are formed with what designers call an involute shape. Because of this, the point of contact between the pinion and the gear always falls on the line of action. This line of action is in the same position as a belt would be if the gear and pinion were two pulleys. Fig. 3 serves to illustrate this.

Under these conditions, power is transmitted smoothly, the gear and pinion acting like two pulleys connected by a non-slipping belt. Therefore, when the pinion is turning at a constant speed, the gear will be driven at a constant speed. The relation between these two speeds is fixed by the relation between the sizes of the gear and pinion.

Now suppose a set of gears is so badly worn or mismatched that the involute shape is gone. When this happens, the line of action of the gear teeth is no longer constant—it jumps around like a belt on two flat-sided pulleys. The result is uneven transmission of power and vibration. For this reason, worn gears set up terrific vibrations which travel through the armature shaft of the traction motor. They enter the bearings, shortening their life. They pass through the armature core into the windings causing them to buzz, break, and wear out the insulation. They are carried through the armature head causing flanges to break, and balance weights to loosen regardless of their original strength. They pass through the magnet frame, breaking field coil and brushholder connectors. They can even cause brushes to dance and ruin commutators. Let's see what this all means. Suppose we have a bad 18-tooth pinion operating at 2,000 revolutions per minute, which is common for a traction motor. It will be pounding at the shaft at a rate of 2,000 times 18, or 36,000 blows a minute. In 30 minutes, it will have piled up a million or so healthy shocks. That is serious, and no fooling!

CAREFUL WITH THAT PINION.—Removing and replacing traction motor pinions are operations that require careful and precise workmanship. A few basic principles must be kept in mind. In the first place, the pinion is made from a special steel. It has been hardened and tempered at the factory to obtain the best possible strength and wear resistance. In removing or replacing a pinion, care must be taken not to raise its temperature above 190 deg. C. (375 deg. F.). If it is heated too much, the hardness of the pinion and its original strength and wear resistance are lowered. This will cause possible failures and rapid wear. By far the best method for removing pinions is to use either a screw type or a hydraulic puller, as shown in Fig. 4.

Sometimes an induction coil is used to heat the pinion which is then removed by wedges, forced between the pinion and the outer bearing retainer. Such methods must be used with caution. The pinion may be damaged by being heated to excessive temperatures. Also, the close running fits on the seals and flingers inside the bearing assembly may be distorted by the pressure of the wedges.

Never try to drive the armature shaft out of the pinion with a sledge because you'll surely crack the hardened thrust flanges of the roller bearing inside the motor. Fig. 5 shows the results of this in one case.

Replacing the pinion on the taper fit on the armature shaft also has its pitfalls. In order to avoid trouble, the following procedure is suggested:

1. Clean the shaft and pinion bore with solvent and remove scratches and dents that will interfere with the pinion fit. The pinion should be checked for a minimum fit of 75 per cent on the shaft. This can be done by lightly bluing the shaft, placing the pinion firmly in place and

(Continued on page 83)

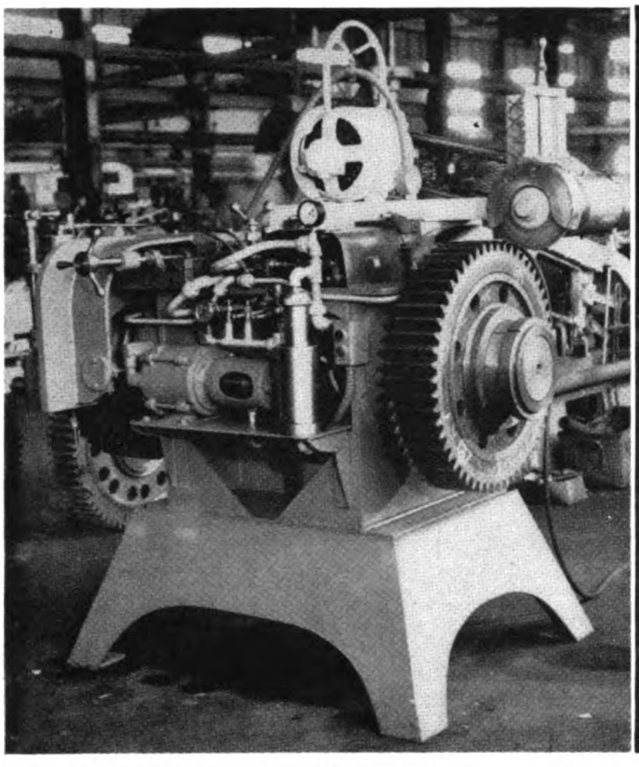


Fig. 1—Gear contour grinder built in the Burlington shops at West Burlington, Iowa

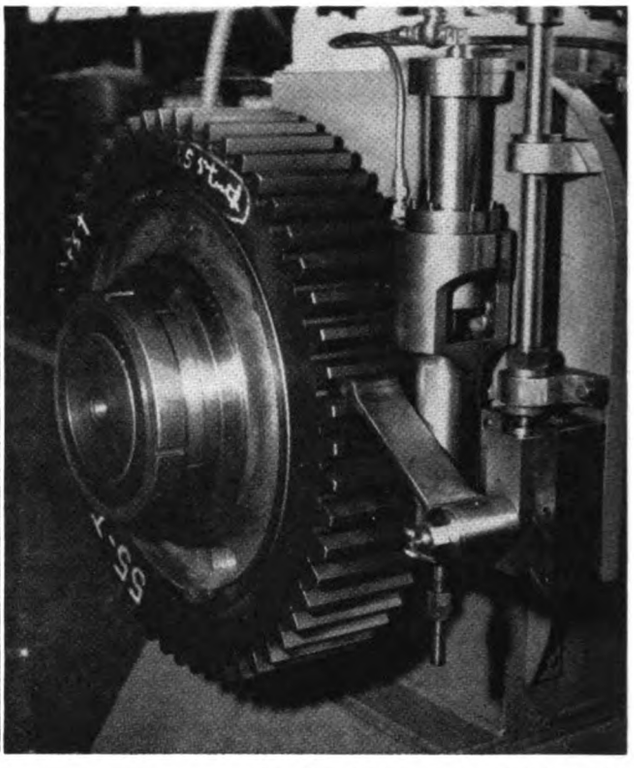


Fig. 2—A new gear is used to position the worn gear on the other end of the mandrel

Contour Grinder For Axle Gears

The Chicago, Burlington & Quincy has added a contour grinder to the list of shop tools used at its West Burlington, Iowa, shops. The grinder is completely shop designed and built, and is used to restore worn tooth contours on diesel locomotive axle gears.

The gear shown at the front of the machine in Fig. 1 is being ground. It is mounted on the shaft by means of an expanding sleeve inside the gear. Mounted on the opposite end of the shaft is a new gear of the same type as the one being ground. The new gear is used as an index positioner for the gear being ground. The manner in which this is done is shown in Fig. 2. After one

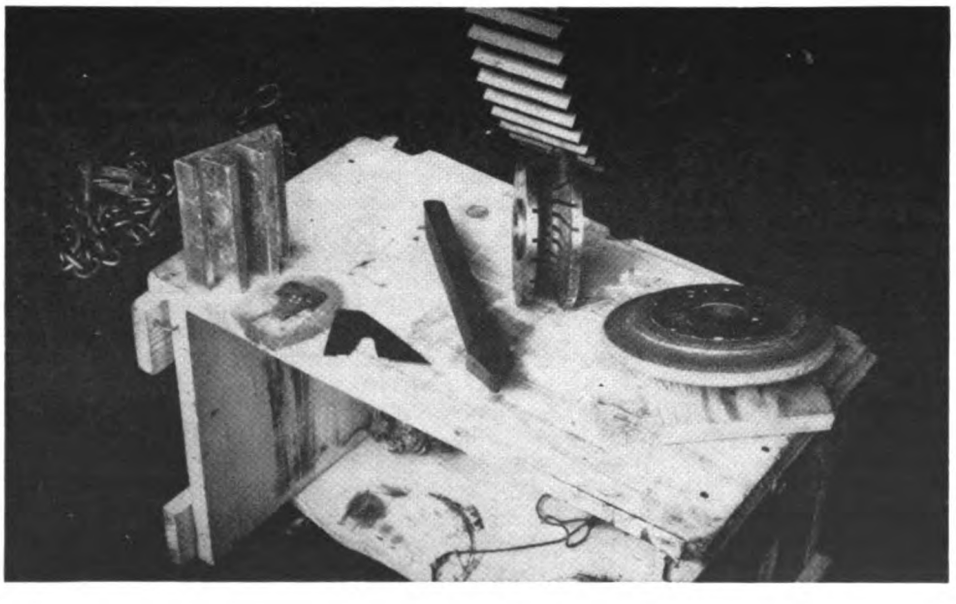


Fig. 3—Casting, templates, lathe tool, crush dresser and contoured grinding wheel

tooth has been contoured on one side, oil is admitted to the lower cylinder, Fig. 2. This advances the gears a little more than one tooth. Oil is then admitted to the upper cylinder which brings the gear back against the dog which stops and holds the gears in the grinding position.

With the gears in the grinding position, the grinding carriage is traversed horizontally along the axis of the machine, moving the contoured grinding wheel along the surface of one tooth, taking off enough metal to restore the tooth to its original contour. This is done before the loss of contour exceeds .020 in.

After the contoured wheel has made its cut, it moves back to its original position and the gear is then advanced automatically to the next tooth position. Once a set-up is made, operation of the machine is entirely automatic until the faces on one side of all teeth are contoured. The operation is then reversed and contours are restored on the other sides of the teeth. The index positioner head may be adjusted over a space of 5 in., thus providing for gears having as much as 10 in. difference in diameter.

A motor-driven pump on the machine supplies oil at a pressure of 10 lb. per sq. in. and this is used to operate the controls shown on the front of the machine, to advance and stop the gears, and to move the grinding carriage back and forth. It is also used to float the carriage on its ways.

The speed of the carriage is controlled by a throttle valve. The grinding wheel is driven by a V-belt from a 5-hp., 3,600 r.p.m. motor, mounted on the carriage. Both the gear-supporting mandrel and the grinder head run on roller bearings.

The manner in which the grinding wheel is contoured is illustrated in Fig. 3. First a lead casting s made by placing a dam around a short section of a new gear. Such a casting is shown at the left. Next to the casting are male and female templates made from the casting, and next is a lathe tool, which, with the aid of the templates, is made to match the gear contour.

The lathe tool is then used to cut the crush dresser shown between the lathe tool and the grinding wheel. Finally, a grinding wheel of rectangular section is contoured with the dresser in the same head used for grinding the gears.

Lubrication of Roller Bearings and Gears

(Continued from page 81)

turning it on the shaft fit. The resulting lines on the shaft will tell how much of the pinion was in contact with the shaft.

2. Spot the cold pinion on the shaft by hand and set the pinion advance gage at zero, as shown in Fig. 6. Chalk mark the pinion and shaft so that you can replace the pinion in the same position.

3. Heat the pinion to the temperature recommended by the manufacturer. Check the temperature with a pyrometer (See Fig. 7) in order to be sure that it is correct. Then line up the chalk marks and quickly snap the pinion on the shaft.

4. Check the advance again with the gage that was set at zero. The reading should fall within the limits given by the manufacturer. If the advance is too large remove the pinion and try it again at a lower temperature. If the advance is too small, try a hotter pinion.

A Good Fit Needed.—Railway pinions and gears, with or without keys, rely on the shrink fit to keep them from turning on the shaft. If the fit is too loose, the gearing will slip on the shaft or axle. An extra tight fit will overstress the pinion or gear, and might cause it to crack. So you can see that it is most important to do a good assembly job in order to give the gearing a good start in life. Even when gearing is properly assembled, it cannot be put in service and forgotten. Visual checks for wear limit and tooth contour should be made periodically when the opportunity presents itself. Detailed methods of inspecting gears, bearings and other equipment will be discussed in a later article.

CONSULTING DEPARTMENT

Where Do Good Foremen Come From?

In your March issue you asked how morale can be made an active factor in the diesel shop. To my way of thinking there is nothing else quite so important as the foreman in building up good morale. Now, what I want to know, is how do we find good men for foremen and how do we train them for the job?

We Need College Men—Lots of Them

Every man, whether an employee of a railroad or some other industry has personal pride. He wants to be part of a successful enterprise, and he wants to know that his efforts are paying dividends. Unfortunately, the railroads are making little money, and the hire-and-fire method of trying to get a good foreman prevails in many places. In fact foremen have had to join labor organizations to keep from being victimized by management. No foreman is happy about the situation. In the past, foremen have always considered themselves part of management. and like everyone else, they want to be proud of their job.

The result of this condition is that it is difficult to get anybody interested in taking a foremanship. The difference in pay has become so small that a couple hours overtime each week will give the worker as much as the foreman.

The usual railroad method of making a supervisor is to wave a magic wand and say to some one, "From today on you're a foreman." The usual result is that the man selected knows nothing about overhead costs, labor-hand-

ling problems, public relations, store expenses, cost of material he uses, etc.

Railroads need college men, and lots of them. They need industrial executives to bring in modern ideas, modern methods and cost accounting. When the shops are given this kind of support, and men are taken into the confidence of management, the biggest obstacles to the selection and training of foremen will be removed.

ROBERT R. BREWSTER
Chicago, Ill.

Preferably Not a College Man

The qualifications of a good foreman are that he should be a good workman at his trade and have sufficient knowledge of any trade likely to come under him to know whether the workman is doing it well or ill. He should have some theoretical knowledge, but should not be overloaded with it. He should be a man who takes an interest in the work as a whole and in his own department in particular, not merely for his own advancement.

Tact in dealing with men is the greatest essential. This can only be gained by experience. This can only be obtained by years in the shop. College or school training which put a foreman above the class of men he must control is inadvisable. The usual signs that a boy will make a good foreman are the interest he takes in his work, the respect with which he treats older and more experienced men than himself, and the ability to work well without being watched.

W. E. WARNER
Woodford Green
Essex, England

Diesel-Electric Locomotive Batteries

Questions and Answers

Q. How can the battery and its compartment be kept clean?

A. It is important that the battery be kept clean. If dirt or acid-soaked mud accumulates on top of the battery, it is an unpleasant job to handle and will eventually cause trouble.

Electrolyte spilled on the battery cell covers, trays or battery compartment, never dries or evaporates. It rots the wood trays, causes grounds, and corrodes any metal parts that are subject to attack from sulphuric acid.

If, during a monthly inspection, the top of a battery is found to be damp with electrolyte, the Electric Storage Battery Company's service engineers suggest that it be neutralized with a solution of commercial bicarbonate of soda, consisting of one pound of soda to a gallon of water. For best results apply the soda solution freely, preferably hot, with a paint brush. The brushing action tends to remove the oil film usually found on tops of diesel locomotive batteries. This is important, because the oil sometimes traps a certain amount of acid on battery cell covers.

Keep vent plugs in place. *Do not allow any of the soda solution to get into the cells. It will neutralize the electrolyte and lower cell capacity.* Sufficient time must be permitted for neutralization. Wait until foaming stops on electrolyte soaked areas, especially on wood trays, and then immediately rinse off with water at moderate pressure, to remove the soda solution. If soda is allowed to dry on top of the battery, it produces a path for current leakage. Allow to air-dry.

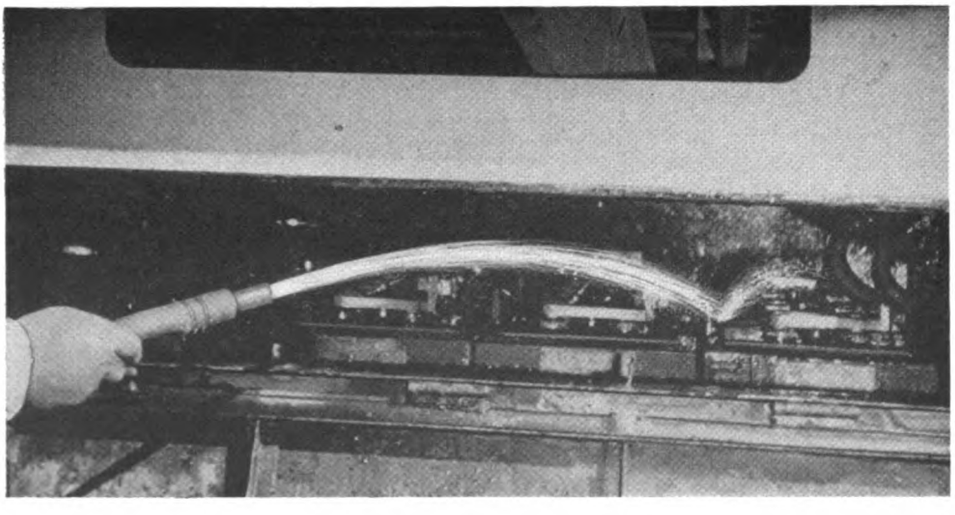
During a regular monthly inspection, if the top of a battery is found to be dry but dusty, it should be rinsed off with water at moderate pressure as shown.

In freezing weather, after rinsing the top of a battery and, if there is not sufficient time for air drying in the shop, low pressure air should be used to blow off the surplus water.

Do not use steam or high pressure air for cleaning or drying, because both will remove the protective grease from the grease ring seal nuts on the posts. This grease prevents electrolyte corrosion of the copper lugs, cables and connector bolts attached to the posts. Steam also tends to remove the protective coating of paraffin and paint from the woodwork, and may damage the sealing between the jar and cover to the extent that resealing might be necessary to prevent loss of electrolyte.

Increase water pressure to wash out battery compartment and dirt from under battery trays. This helps to prevent grounds.

S. K. LESSEY
The Electric Storage Battery Company



Using low pressure water to hose down a locomotive battery

EDITORIALS

Safety in Operation of Wrecking Outfits

Railroads generally prefer the term "derailment" to "wreck" for obvious reasons and yet the special train and equipment used in replacing derailed cars and locomotives or otherwise clearing blocked tracks for operation are commonly called "wreck trains," or "wrecking outfits." In discussing this subject at a meeting of the Car Foremen's Association of Chicago early this year, A. F. Waddell, wrecking foreman of the New York Central at Englewood, Ill., made a number of suggestions in the interest of safety which may well be elaborated.

The first consideration at the scene on a derailment is the safety of all present. This means keeping spectators at a reasonable distance. It also means the use of standardized, pre-tested equipment and tools of all kinds on the wreck train, kept in specified locations where they can be quickly found and easily made available at a moment's notice. Above all, a wrecking foreman is needed who has the ability to size up conditions at any derailment and the experience to know what general procedure is likely to restore the line to operation with the least possible delay and damage to equipment and other railroad property, and whose decisions are never hasty but are, none-the-less, arrived at quickly. It was testified at the meeting that no competent wrecking foreman will ask any member of his crew to go into a place or do any job he would not do himself. As a result of all of these qualities wrecking crews learn to have confidence in the judgment of their supervisors and to obey instructions promptly and willingly.

Other important considerations are the question of authority at the scene of the derailment, and the method of transmitting signals. Since there cannot safely be more than one "boss" in an operation of this kind, the wrecking foreman generally is given full authority and responsibility. To give him less is dangerous and likely to result in confused procedure. He alone issues instructions, or gives signals for each move to be made. As a further precaution against confusion in signals from unauthorized persons during night operation, one practice successfully followed has been for the wrecking foreman to use a personal and exclusive colored light, such as green, in passing signals to the crane man and directing general operations.

One comparatively new problem which confronts wrecking crews to an increasing extent as diesel motive power becomes more widely used is how to get this type of locomotive back on the rails quickly and with the least possible damage. In extreme cases, the locomotive may actually have to be rolled and considerable damage is unavoidable. In other instances careful jacking or lifting at the jacking pads accomplishes desired results with little or no damage to the locomotive. Judging from discussion at the meeting, it is difficult to rerail a diesel locomotive by direct pull without damage to gear housings, traction motors and brake rigging, especially when rails are high. If pulling is the only method feasible to use, it was suggested that power judiciously applied to diesel wheels at the same time will help.

When a road diesel is practically in line with the track and must be approached by the wrecking crane directly from one end, it is sometimes found impossible for the crane hook to reach far enough to make the lift from jacking pads without damaging the front end, or end vestibule. In this case experience shows that a simple lifting yoke of proper design may be applied to the end coupler and permit making the lift from this point without bending the coupler or damaging the coupler horn and head block. In all cases of doubt regarding the lifting capacity with the crane boom at various angles, carefully blocked outriggers are an obvious necessity. Safety in this respect must depend upon the experience of the wrecking foreman and thorough knowledge of his equipment.

How Many Tests Do Repaired Parts Need?

Railroads can spend far too much time and money on testing repaired parts or parts removed for inspection. They can also spend so little that operation is plagued with road failures, the measurable damage alone from which can cost dollars for every penny saved by cutting inspection costs. Striking a balance between inadequate testing and overly elaborate testing is oftentimes as difficult a task as it is vital.

For two good reasons, shops are more likely to err on the side of inadequate testing. One, of course, is the pressure to get the work out on time. The second is that shops frequently lack the equipment to do the job thoroughly and efficiently. Without the high production volume of a manufacturing industry, a railroad cannot too easily justify elaborate equipment for quality control purposes.

When, in some instances, such elaborate and expensive equipment is acquired, there can exist a natural tendency to overrate it because the new equipment is far better than anything else that was used before, and because it is often far more impressive than any other piece of equipment in the shop.

When, then, defects do occur on parts that have been inspected, they are likely to be considered to have originated after inspection, without determining if perhaps the machine was improperly operated or whether the defect was outside of the scope of the machine to detect. Neither condition is always easy to find, but both prob-

ably exist to a greater extent than generally realized.

A good example of the latter can be found on a road that had difficulties with diesel cylinder heads and liners failing in service, frequently only a short time after being overhauled. Testing diesel-engine heads with cold water at 60 p.s.i. detected the cracks that Magnafluxing missed, and virtually eliminated road troubles from this source. This is a good example of how a supplementary test can be useful. There are probably many other instances where a supplementary test would be of equal value in detecting the small percentage of defects that the main test fails to locate.

Gear Contour

A little over a year ago, a railroad which had developed an enviable record for doing good traction-motor repair work at low cost, began to lose that record at an alarming rate. It had been getting 900,000 miles of service between motor rewinds and this fell off so that some motors failed to make 100,000 miles. New motors did not do as well as those overhauled in the shop. Insulation failed and the copper in the coils broke, with resultant motor failure.

Many explanations were offered, but none of them has so far afforded a solution to the difficulty. The latest of these was the correction of a practice which permitted the use of three different axle sizes on a single size of motor support bearing. This resulted in as many as three steps on the contour of gear teeth, and could have caused damaging high-frequency vibration. Other operating practices may also have contributed to short motor life, but this cause has been reduced to the extent of matching axles and bearings, and performance improvements are anticipated.

Manufacturers have long recommended keeping a pinion and its gear together throughout the life of the pinion, but railroads have found this impracticable. A development on the Burlington offers a possible means of improving performance of gears and motors in any application. It consists of a shop-made machine, described in the electrical section of this issue, which not only removes the steps from gears, but also restores their original contour.

It has long been suspected that vibration in service, particularly if it is of relatively high frequency, causes insulation and perhaps the copper of coils to deteriorate rapidly. If records can be kept to show relative performance of motors operating with gears which are kept in contour, and motors operating with gears which are not, it may result in an important contribution to the reduction of motor maintenance costs.

NEW BOOKS

THE STEAM LOCOMOTIVE OF TODAY. *By M. P. Sells, O.B.E., M.I.Mech.E., M.I.Loco.E. Published by The Locomotive Publishing Co., Ltd., 88 Horseferry Road, Westminster, S.W.1. 250 pages, 5 in. by 8 in.*

A part of this book was originally written in 1934 for the African Locomotive running staff of the Nigerian Government Railway and was first published in 1936 under the title "How the Locomotive Works and Why." The book now includes some notes on shop practice, tolerances, scrapping sizes, clearance limits, etc., as well as new and enlarged diagrams. Its chapters discuss fuel and its combustion; evaporation of water into steam; principles of expansion of steam and work done during expansion; tractive force; brakes and brake equipment; lubrication; locomotive failures; duties of firemen and enginemen, etc.

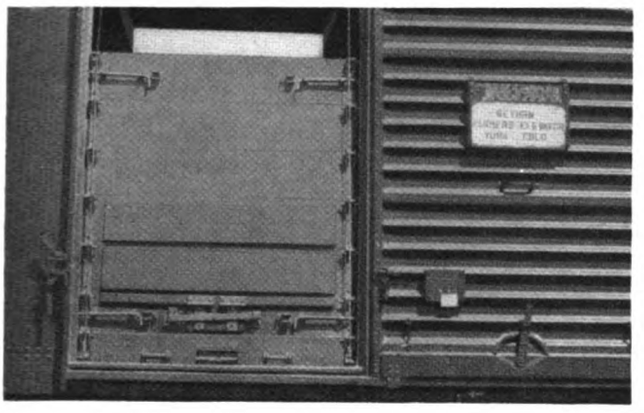
VIBRATION AND SHOCK ISOLATION. *By Charles E. Crede. Published by John Wiley & Sons, Inc., 440 Fourth avenue, New York 16. 328 pages, 6 in. by 9 in. Price, $6.50.*

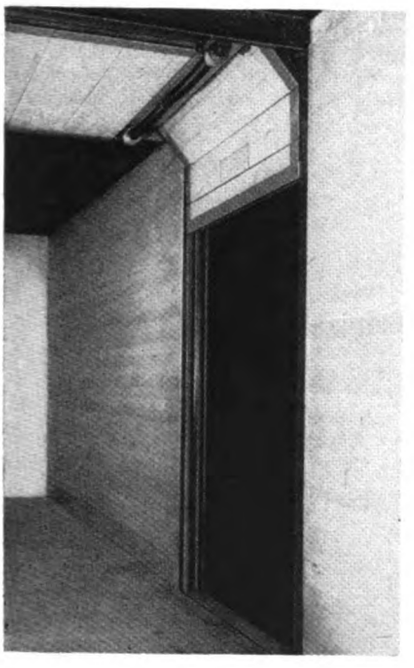
The information in the six chapters of this book for the practicing engineer has been compiled from technical literature and commercial brochures, supplemented by experience gained from engineering practice. It concentrates on the principles of isolation and the design of isolators, rather than on general vibration theory and practice. Isolation is treated both from analytical and descriptive points of view. The causes of vibration and shock are analyzed and the use of natural and synthetic rubbers, metal springs, felt and cork for designing isolators evaluated. Train and road-vehicle installations are among the particular applications of isolators discussed in Chapter 6.

THE PRACTICAL ENGINEER POCKET BOOK, 1951. *Edited by N. P. W. Moore, B.Sc., A.G.G.I., D.I.C., A.M.Inst.F. Published by the Pitman Publishing Corporation, 2 West 45th Street, New York. 744 pages, Price, $3.*

The internal combustion engine section of this edition of the Pocket Book, a publication prepared in Great Britain, has been extended to include information on the properties of compression ignition fuels, and a brief section has been added on the supercharging of engines. A section has also been included on the gas turbine. Provisional basic data on the proposed unified standard screw threads have been included, and the revised list of British technical journals has been supplemented with a selected list of American journals. A German dictionary has been included with the technical dictionaries in French and Spanish. Among the other subjects covered in the 22 sections of the book are steam and steam generation, the steam engine, locomotive practice, steam turbines, condensers, gas and oil engines, air compressors, air and ventilation, welding and cutting, etc.

NEW DEVICES

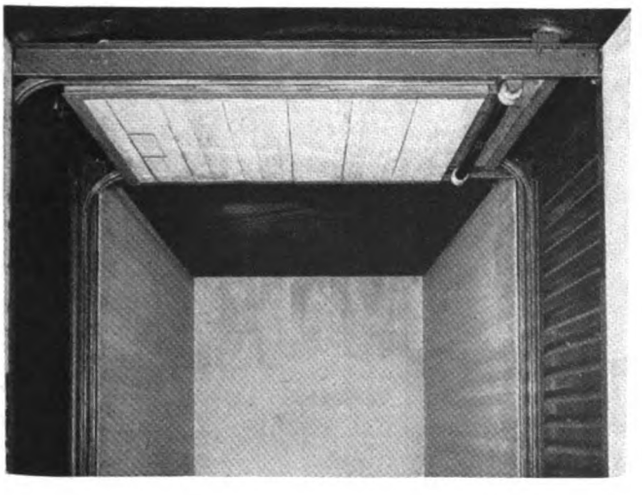




▲ Side door protection is provided for all kinds of freight, and the expense of barricading the regular car door is eliminated

◀ When the door is in the raised position, opening is not obstructed in any way

▼ Door stored out of the way



Permanent Grain-Tight Door

A permanently installed grain-tight door now available for application to box cars prevents the loss of wheat, corn and other bulk commodities during shipment, and serves as side-door protection to freight in boxes, crates, bales and sacks. In addition to reducing loss and damage, the door, being a permanent installation, further eliminates the problems and expenses involved in purchasing, handling and installing the side door protection required for many shipments. No further cost is incurred by either the shipper or the railroad for barricading the door.

This device, named the Utility All-Purpose Door, operates on the same general principle as the modern overhead garage door. It is completely out of the way when not in use; one door nests over the other close to the roof of the car leaving the regular side doorways unobstructed for loading or unloading.

All hardware is disposed outwardly from the inside surface of the car, thus presenting a smooth, continuous surface to prevent damage to freight due to contact with door posts. For easy operation the doors are individually counter-balanced by a torsion spring and drum arrangement. Before being placed in service all operating hardware was given an accelerated lifetime test of 5,200 full opening and closing cycles on a full size model.

The door consists of a pair of overhead doors operating on floating rollers running in steel channel tracks sturdily designed to withstand the normal impacts that might be expected during loading and unloading. Each door consists of a series of wood panels joined together, with a total height of 80 in. and extending across the width of the side door opening. If side-door protection above 80 inches is required, provision has been made for hooking the operating cables to the door posts so that a supplementary grain door can be nailed to the door posts on the inside of the car at the top of the utility door.

Additional protection against leakage is afforded by the arrangement of hinge plates on the insides of the door posts, sealing strip at the bottom, and the ship-lap construction of the wooden panels.

A small relief door is incorporated near the bottom of the Utility All-Purpose Door for unloading grain or other bulk commodities. Opening this relief door and allowing the grain to run out for a few minutes reduces the pressure against the main door, permitting it to be raised easily.

Twelve carload shipments were tested in a Burlington car using this door with an average length of haul of 370 miles. Ten of the shipments were grain in bulk—eight loads of wheat and one each of corn and mixed grain—with a weight average of 122,000 lb. No appreciable loss of grain was reported in any shipment. Two miscellaneous loads, were also tested, one carload of 800 100-lb. paper sacks of sugar and one of a full carload of empty tin cans. There was no damage to either shipment.

Speed in loading was demonstrated one day at Yuma, Colo., when the test car equipped with the Utility All-Purpose Door was brought in on the local freight and

spotted at the elevator. Before the balance of the station switching was done, the car was loaded, ready to move.

The Utility All-Purpose Door is a product of the Richards-Wilcox Manufacturing Company of Aurora, Ill., represented by I. W. Preetorius, freight traffic consultant, and F. F. Frye, 20 No. Wacker drive, Chicago.



Oxy-Acteylene Cutting Blowpipe

The ease which which this giant size hex nut, for a 250-ton hydraulic press at the plant of the General-American Transportation Co., Sharon, Pa., is cut to shape by the oxy-acteyline cutting process is graphically illustrated here.

The Oxweld C-37-R Cutting Blowpipe, developed by the Oxweld Railroad Service Co., Division Union Carbide & Carbon Corp., New York 17, easily slices through the 24 in. low-carbon steel billet at the rate of 3 in. per min.

In processing the giant nut, a hole was first cut out of the center of the block whose sides are then cut in the shape of a hexagon. After being cut into shape, the nuts are threaded for colmun bolts in a hydraulic press. No other machining is necessary.

◆

Printed Straw Slot Dixie Cup Lid

The Dixie Cup Co., Easton, Pa., has announced a new printed straw slot lid for Dixie Cold Drink Cups to replace its plan tab lid.

The straw slot is a U shaped, liquid-tight opening designed to meet the demand from airlines, railroads, and other similar customers concerned with the danger of drinks spilling. To insert a straw, the user simply presses in with finger or straw.

All lids will be treated after the straw slot is cut, making them substantially spill-proof for use in the normal manner.

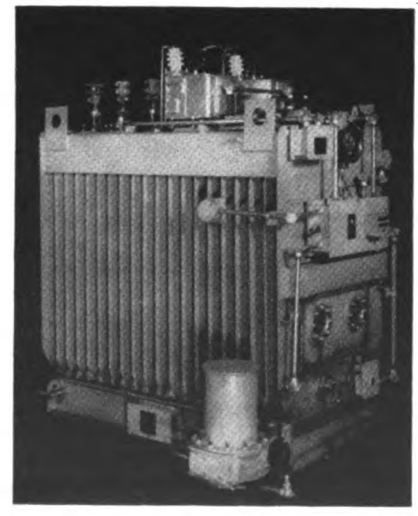
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Vaporization-Cooled Transformers

A vapor-cooled, vapor-insulated transformer that is expected to be ¼ to ⅓ lighter than liquid-immersed units of equivalent rating and performance is being developed by the Westinghouse Electric Corporation. The new cooling technique that utilizes the heat of vaporization of liquid fluorocarbons for cooling and the dielectric strength of fluorocarbon vapor for insulating, is a joint development of the Transformer Division and the Research Laboratories. Cooling is effected by spraying liquid fluorocarbon over core and coils. It then forms a vapor which fills are spaces in the tank. The vaporized fluorocarbon in turn is forced through cooling tubes and returned to the sump as a liquid.

Fluorocarbons have a suitable boiling point and heat of vaporization, and they have a high dielectric strength and impulse strength at low pressures. In fact, the 60-cycle dielectric strength of fluorocarbons in a reasonably uniform field at atmospheric pressure is greater than that of transformer oil.

Two vaporization-cooled transformers have been constructed and operated. The first experimental unit was a modified standard dry-type transformer. Equipped with adequate cooler capacity, the unit delivered in excess of 350 per cent of its rated capacity, dissipating ten times more heat than a dry-type transformer could have.

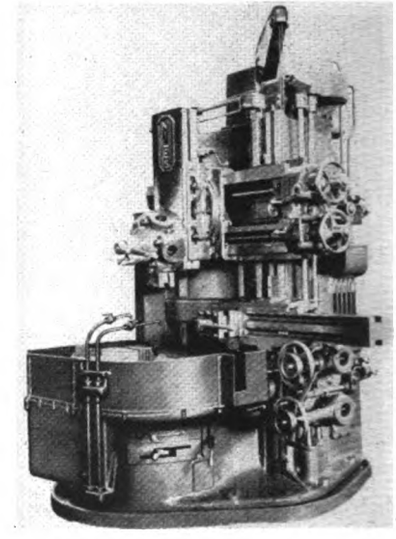


The second experimental unit, a specially-constructed 500-kva., $^{2400}/_{240}$-volt transformer, has been operating at rated load since the first of the year.

A vaporization-cooled trasformer should be safe or safer than liquid-immersed or dry-type transformers because the fluorocarbon liquid is not only non-inflamable, but has fire-extinguishing properties. Heat transfer by vaporization is far superior to that obtained with circulating oil. Therefore, it is possible to design a more compact coil assembly and to reduce the external cooling surface.

Where a degree of safety is required that is not obtainable from liquid-immersed transformers, where space and voltage requirements rule out dry-type transformers, and where extremely compact installations with forced external cooling or a remote cooler are required, a vaporization-cooled transformer may provide the most suitable and economical answer.

◆



Vertical Boring and Turning Mill

A Niles 42 in. vertical boring and turning mill with side head is now available for heavy-duty production, maintenance and job shop operations. Known as the Side Head Mill, it has been modernized by increased table speeds and corresponding feed changes; by use of anti-friction bearings in the table speed change gear box and table mounting; and by a higher powered drive from a 30-hp. motor.

The unit combines the advantages of a turret lathe, engine lathe, and vertical boring and turning mill, with independent or simultaneous engagement of down and

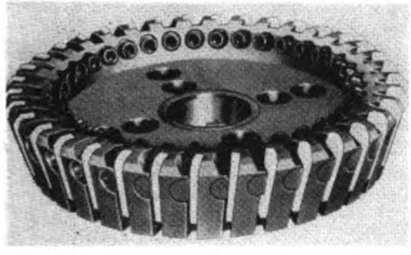
cross feed or power traverse for both rail head and side head.

Accuracy of this machine announced by the Baldwin-Lima-Hamilton Corp., Hamilton, Ohio, is provided by several features including integrally cast column and base, a three-track coss-rail and an elevating screw adjacent to the narrow guide. A center stop which locates the rail head and maintains alignment between it and the center line of the table spindle is an important feature essential for accurate boring with double head cutters, for drilling and reaming.

Actual swing with side head down is 50 in. Maximum distance from table top to turret face is 48 in. The vertical head, which has five faces, has a slide travel of 28 in. and will swivel 45 deg. to either side of vertical position. The side head, which has four faces, has a vertical working travel of 35 in. and a horizontal travel of 21 in.

There are 12 table speeds ranging from 9 to 200 r.p.m. and 16 feeds for either vertical or side head between 0.003 and 0.520 in. per revolution of the table. This machine occupies a floor space 8 ft. 4 in. wide by 8 ft. 10 in. deep and stands 10½ ft. high.

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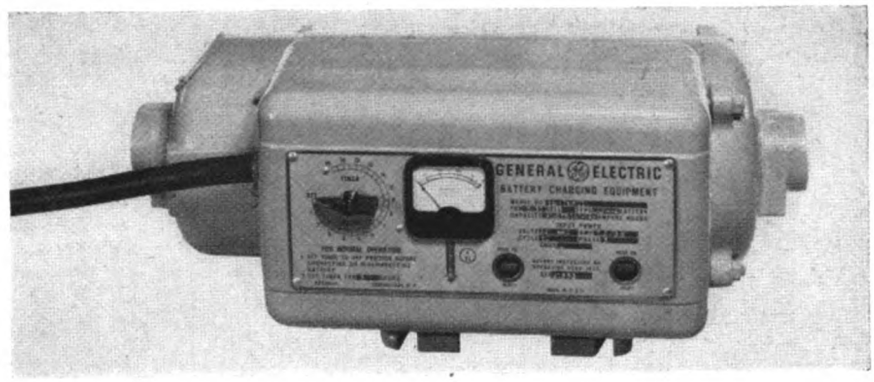
High Speed Axial Face Mill

Recently introduced for general purpose and continuous production milling is the simplified axial face mill, style MF Kennamill by Kennametal Inc., Latrobe, Pa. Having wedged-in blades and structural features, the mill makes possible the removal of cast iron at from 60 to 70 in. of the table travel per min.

This mill has four parts: body, blades, wedges and nuts. The wedges and screws are a one-piece alloy steel and remain assembled to the cutter body at all times, reducing the possibility of lost parts.

The blades are heavy, solid, and wedged-in. No hammers or special tools are needed to tighten them, a simple hex wrench suffices. Blades are available in two styles —for cutting to a square shoulder or to a 45 deg. corner. They are interchangeable in all slots of any size of cutter body of the same type. Wedges are round and are interchangeable in any slot of any size cutter, either right- or left-hand. They do not have to be pried out, but can be readily loosened with a soft hammer.

The face mill is made in seven cutting diameters: 6, 8, 10, 12, 14, 16, and 18 in.; either right- or left-hand.



Battery Charger For Shelf Mounting

A motor-generator type battery charger, designed to permit mounting on balconies or shelves to save floor space, has been announced by General Electric's Small and Medium Motor Divisions.

For charging batteries in driver-lead and small driver-ride industrial lift trucks, the new unit accommodates lead-acid batteries of 6 to 19 cells and nickel-iron-alkaline batteries of 10 to 30 cells. It is about the size of a tank type vacuum cleaner with a control box mounted on its side, weighs 190 lb., and can be installed on a shelf measuring 6¾ in. x 8¼ in.

To place a battery on charge, it is only necessary to plug it in, and set the timer; automatic controls do the rest. Voltage based on the number of cells) and current based on ampere-hour battery ratings) are adjustable.

Protection from external damage to the charger is provided by completely enclosed construction. Permanent bearing alignment, established by factory assembly, cannot be disturbed during mounting. Incorporated in the design of the new unit are a number of features recommended by the Industrial Truck Association. Included are: automatic disconnection of charger from power line and opening of charging circuit in case of power interruption, automatic restart of charger upon resumption of power supply following an interruption, automatic control of charging rate under the modified constant voltage charging system, and automatic cut-off of battery and shutdown of charger when the battery is fully charged.

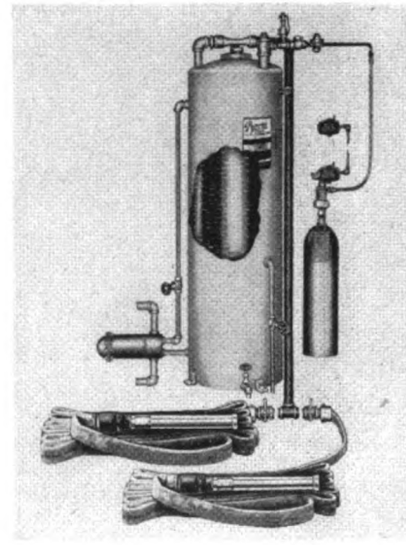
The single-circuit equipment operates on 3-phase, 60-cycle, a.c. power, and has generator-overload and motor-overload protection to guard against excessive currents.

Self-Contained Air Foam System

Completely independent air foam fire extinguishing system for locations without water supply or adequate water pressure has been announced by the Pyrene Mfg. Co., Newark, N. J. A number of railroads have equipped all of their diesel locomotives with this foam system.

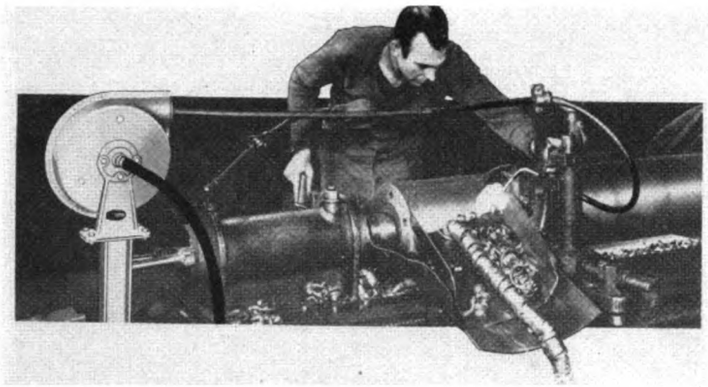
The system illustrated shows a typical installation for a diesel locomotive which may be operated by one man from either side of the locomotive. Operation is started by pulling a handle in the manual control pull box which releases gas from a carbon dioxide pressure cylinder to provide pressure within a water tank. The discharging water passes through a foam compound into the water stream.

The mixture of water and foam compound are then discharged to the Pyrene Foam Playpipe. At the playpipe, the mixture is converted into air foam or mechanical foam which flows over the surface of blazing liquids or blankets burning solids to shut off the supply of oxygen and smother the fire. The 100 gal. of water and 6 gal. of foam compound carried in the unit will produce as much as 1,750 gal. of foam at the rate of 350 gal. per min.



This unit is compact and occupies only 24½ x 24½ x 70 in. and when fully charged weighs approximately 1,600 lb.

In case of derailment, the system will operate even in a horizontal position. If protection against freezing is needed for a diesel locomotive installation, a heat exchanger as shown may be used.

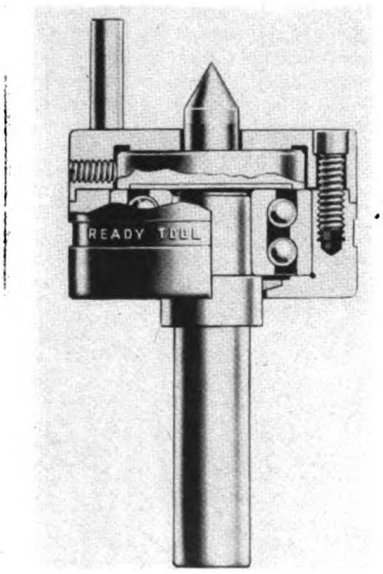


Machine Tool Hose Reel

An important new application of a Wayne Hose Reel to machine tool operation has been perfected by The Wayne Pump Co., Fort Wayne 4, Ind. The hose reel may be used with water, fluid lubricants or coolants.

A standard reel is attached to the end of a lathe or other machine requiring the addition of a coolant. The liquid is fed into the reel and through the hose to the cutting tool head. The hose moves automatically, following the tool with cooling liquid allowing the operator to give full attention to his work.

This hose reel is a compact unit which can be mounted anywhere on the machine tool. In addition to the uses described above, it may be used as a bench reel to supply portable air tools. It provides bolt tool suspension and air supply in one unit.



Floating Type Anti-Friction Center

An adjustable floating type center, with which expansion type hand reamers can be correctly ground, so that the reamer teeth will be concentric with the front pilot surface, has been developed by the Ready Tool Co., Bridgeport 5, Conn. This operation is done simply, in a universal tool and cutter grinder, eliminating a cylindrical grinding operation.

The method of grinding expansion hand reamers, using this center is to first adjust the expansion plug of the reamer so that the highest micrometer reading obtainable is from 0.002 to 0.004 in. over the nominal size. Since hand reamers are always ground with a taper or lead, in order to allow them to enter holes freely and without chattering, the swivel table is readjusted to produce the desired lead. Each blade is then backed off, so as to leave practically a sharp cutting edge.

The amount of lead depends upon the amount of stock to be removed by reaming and is, generally, from 1/16 to 3/8 in. per ft. and approximately 1/2 in. in length for reamers up to 2 in. in diameter and 3/4 in. in length for larger sizes.

These centers are available in various tapers or straight shank sizes and can be adapted to any type of universal tool and cutter grinder.

◆

Self-Contained Ring Packing

A new automatic ring packing called Uneepac, has been developed. It is a molded packing and each ring is a complete, self-contained packing unit.

According to the manufacturer, the product is valuable in the design of new equipment and opens the way for many desirable savings. It is designed for maximum sealing efficiency in minimum packing depth so stuffing box sizes can be reduced. No follower or header rings are needed.

Each ring centers itself perfectly on the preceding ring. This reduces the chance of human error. In service, each lip is always exposed to fluid pressure which provides instantly responsive, positive sealing. Since Uneepac does not depend on gland pressure for sealing, friction is reduced and there is less wear on both rod and packing.

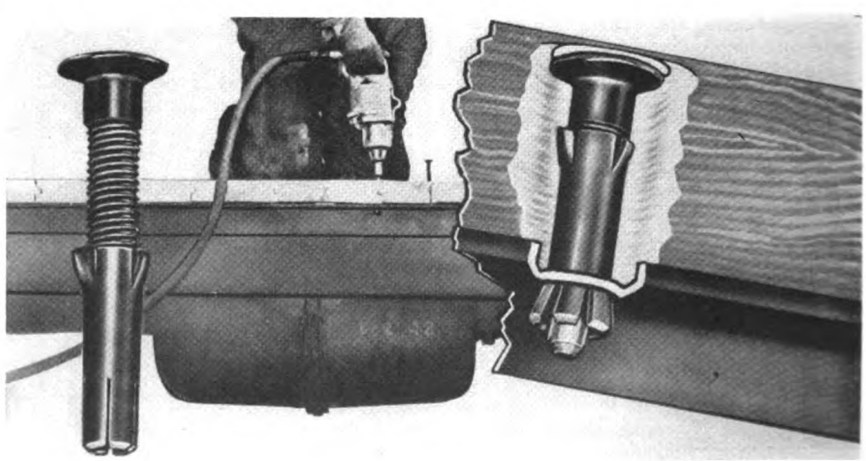
Manufactured by Johns-Manville, New York 16, it is offered in varied compositions to suit different services—water, steam, oil, air, gas, vacuum and so forth. The packing is furnished in sets of endless or split rings and is available for shafts 5/8 in. diameter and up.

Self-Locking Sleeve Fastener

Created to reduce labor costs, a one-man expansion sleeve bolt fastener has been made available by the Chicago Drillet Division, Square Tool & Die Co., Chicago 22. Primarily, it eliminates the helper required in inserting and tightening up the conventional bolt and nut as no nut is utilized.

The bolt is simply inserted into its hole. A pneumatic tool drives the bolt through its sleeve and expands 6 prongs at the bottom of sleeve. This forms a tight grip which cannot work loose due to vibration.

The device is made in diameters from 1/4 in. to 1 in. and in lengths from 1 in. up with hex, square, round, flat or slotted heads.



Hand Operated Air Grinder

An air grinder, announced by the Ingersoll-Rand Co., New York 4, has an added safety device to prevent overspeed operation and possible accidents. This unit has special application in foundries, steel mills, and metalworking plants where hand grinding is required for snagging, trimming, smoothing, etc.

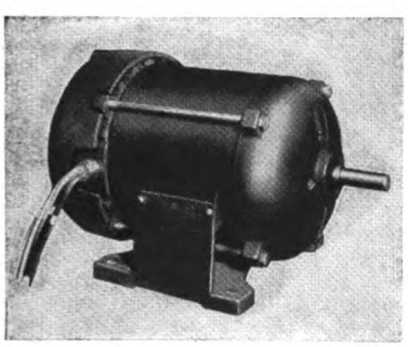
The device contains a motor governor to maintain correct wheel speed, plus a built-in unit called the overspeed safety coupling. In case the motor overspeeds because of governor wear, abuse, maladjustment or dirty air, this coupling automatically uncouples the arbor and the grinding wheel from the motor, making it impossible to operate the grinder until the cause of overspeeding has been corrected.

Another safety feature is a multiple exhaust system. The operator can choose any one of four exhaust positions, spaced 90 deg. apart, and thus direct exhaust away from work and from his own body.

In addition, it has a safe-carrying grip type handle which is designed with enough space between the throttle lever and the back of the handle for a comfortable hand hold.

The grinder is available for 8, 6, or 5 in. wheels, running at respective motor speeds of 3,100, 4,100 and 4,500 r.p.m. Overall length is 24⅝ in. with straight handle and 22½ in. with grip handle. Maximum side to center distance is 2-5/16 in. and it weighs approximately 16½ lb. with guard.

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Totally Enclosed Capacitor Motors

General Electric's Tri-Clad line of single-phase capacitor motors has been extended to include a totally enclosed fan-cooled construction. Features of the new design include starting capacitors and a switch mounted within the frame to provide maximum protection with minimum space requirements.

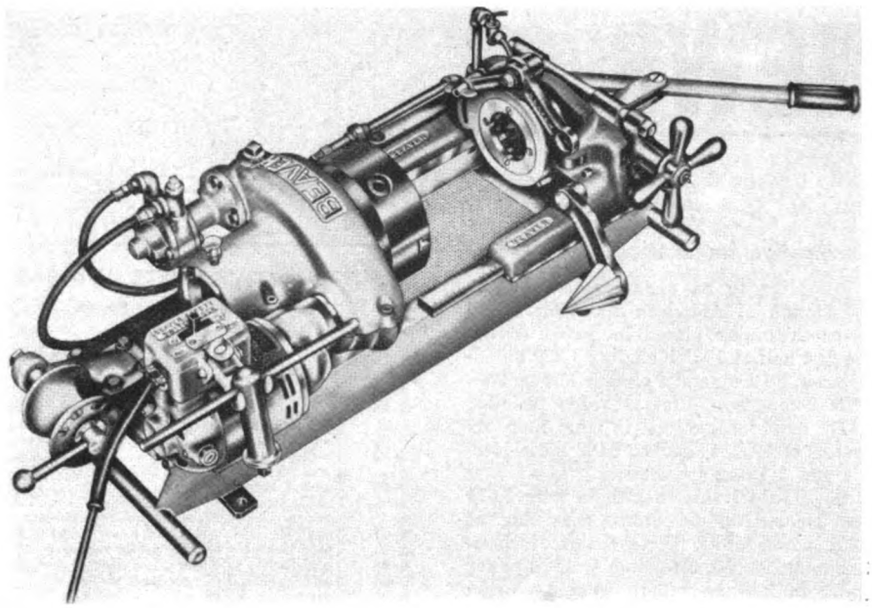
Available in ratings of 1, 1½, 2, 3, and 5 hp., the new line was developed for use where extra severe conditions of dirt, grit, or moisture are encountered. It is also offered in explosion proof and dust-explosion proof construction for installation in hazardous locations. Typical applications are: coal stokers, exhaust fans, grain elevators, and fuel pumps.

Of cast iron construction, the new motors feature the standard Tri-Clad protection against physical damage, electrical breakdown, and operating wear and tear. Being capacitor motors, they have no brushes or commutators to interfere with radio or television reception.

The motors have cast aluminum squirrel-cage rotors and are equipped with long-life ball bearings which will run for years without attention. Easily accessible grease fittings simplify relubricaion when it does become necessary.

Except for the 5-hp. size, which uses 230 volts only, the new motors operate on 115/230-volt, 60-cycle power supply.

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Pipe Threader Has Safety Device

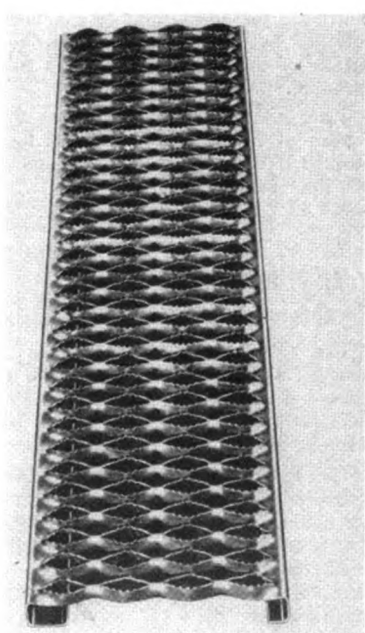
The model "E" lightweight economy model manufactured by Beaver Pipe Tools, Inc., Warren, Ohio, is now equipped with a Safety Switch Lock. Adding this feature gives the pipe tool the same advantages as the larger and more expensive models A and B. To complete the picture, power units C1 and C2 are also protected with the same safety switch lock.

This switch lock is an important device protecting workmen, as well as machine, against possible injury. With the device it is impossible to start the model E unit unless chuck wrench has been removed from the chuck and placed in its holder. This feature replaces the old-style ejector that ejected only special types of wrenches. Now, no special wrench is required.

Anti-Skid Strut Grating

The production of a new development called Grip-Strut Grating has been announced by its manufacturer, The Globe Co., Chicago. Its descriptive name is derived from the nature of the product which presents an anti-skid surface on the edges of a series of formed struts.

Strength coupled with light weight recommends it for uses such as railroad running boards, cat walks, work platforms, etc. Metal for forming into longitudinal channels, step risers, step nosing or mouldings is integral with the grated surface, eliminating the need of welding in many applications.



This one piece grating appears as a diamond shaped pattern in which the percentage of open area is in excess of 75 per cent of the total recticulated surface.

(Continued on page 118)

NEWS

Locomotive Installations

According to an announcement by the Association of American Railroads. 1,309 locomotives were placed in service during the first half of 1951 including 1,229 diesel-electrics, 8 steam and 2 electric loromotives.

By comparison, Class I roads installed 1,127 new locomotives in the first six months of 1950, including 1,122 diesel-electric and 5 steam locomotives.

As of July 1 this year there were 1,674 new locomotives on order, consisting of 2,251 power units. Diesel-electric locomotives totaled 1,658, consisting of 2,223 power units. In addition, there were 14 steam locomotives and 2 electric, the latter consisting of 4 units.

New locomotives on order on July 1 last year totaled 1,000, of which 973 were diesel-electric, 23 steam and 4 electric.

D. P. A. Announces 4th Quarter Allotments

THE railroad program has been allotted 1,872,425 tons of steel, 64,355,000 lbs. of copper, and 8,500,000 lbs. of aluminum under the Controlled Materials Plan for this year's fourth quarter. This and other fourth-quarter allotments were announced July 27 by Manly Fleischmann, administrator of the Defense Production Administration.

Other allotments included those to the Bureau of Public Roads—250,050 tons of steel, 1,150,000 lbs. of copper, and 520,000 lbs. of aluminum.

T. C. Plans for Equipment Purchases in Fiscal '52

THE Transportation Corps has announced that it plans to purchase 6,040 pieces of railway equipment during the 1952 fiscal year. Total cost of this equipment is estimated at $115,267,685.

The T. C. outlined its plans during the course of hearings before the House Appropriations Committee. It is understood that acquisition of this equipment will depend "on how the national steel picture shapes up," assuming that Congress appropriates the money.

A breakdown of the new equipment is as follows:

426	diesel-electric locomotives	$69,490,000
57	railway cranes	2,926,000
2,312	boxcars	10,638,000
100	refrigerator cars	800,000
878	flatcars	9,240,000
648	tank cars	4,366,000
1,208	open cars	4,876,000
254	inspection and maintenance cars	176,685
147	special cars	12,755,000

During the hearings before the House

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item	No.		Month of April 1951	Month of April 1950	4 months ended with April 1951	4 months ended with April 1950
3		Road locomotive miles (000) (M-211):				
3-05		Total, steam	26,341	28,580	108,774	107,076
3-06		Total, Diesel-electric	21,784	16,678	82,750	63,549
3-07		Total, electric	858	858	3,274	3,193
3-04		Total, locomotive-miles	48,984	46,124	194,815	173,837
4		Car-miles (000,000) (M-211):				
4-03		Loaded, total	1,755	1,573	6,865	5,790
4-06		Empty, total	920	889	3,370	3,174
6		Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01		Total in coal-burning steam locomotive trains	45,835	49,987	184,636	169,619
6-02		Total in oil-burning steam locomotive trains	13,048	10,563	48,545	43,367
6-03		Total in Diesel-electric locomotive trains	61,499	47,553	230,610	178,472
6-04		Total in electric locomotive trains	2,330	2,350	8,940	8,305
6-06		Total in all trains	122,720	110,493	472,812	399,845
10		Averages per train-mile (excluding light trains) (M-211):				
10-01		Locomotive-miles (principal and helper)	1.04	1.05	1.05	1.05
10-02		Loaded freight car-miles	39.70	38.00	39.20	37.10
10-03		Empty freight car-miles	20.80	21.50	19.30	20.40
10-04		Total freight car-miles (excluding caboose)	60.50	59.50	58.50	57.50
10-05		Gross ton-miles (excluding locomotive and tender)	2,775	2,671	2,701	2,566
10-06		Net ton-miles	1,287	1,201	1,262	1,147
12		Net ton-miles per loaded car-mile (M-211)	32.40	31.60	32.20	30.90
13		Car-mile ratios (M-211):				
13-03		Per cent loaded of total freight car-miles	65.60	63.90	67.10	64.60
14		Averages per train hour (M-211):				
14-01		Train miles	17.30	17.10	16.80	17.00
14-02		Gross ton-miles (excluding locomotive and tender)	47,430	45,044	44,792	43,027
14		Car-miles per freight car day (M-240):				
14-01		Serviceable	47.70	46.20	46.00	42.00
14-02		All	45.60	43.00	43.90	39.00
15		Average net ton-miles per freight car-day (M-240)	971	868	947	778
17		Per cent of home cars of total freight cars on the line (M-240)	36.50	43.70	35.30	47.50
		PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3		Road motive-power miles (000):				
3-05		Steam	10,307	11,938	44,537	44,536
3-06		Diesel-electric	15,821	14,217	62,052	55,859
3-07		Electric	1,601	1,609	6,452	6,364
3-04		Total	27,729	27,765	113,040	106,760
4		Passenger-train car-miles (000):				
4-08		Total in all locomotive-propelled trains	269,197	263,289	1,090,212	1,028,779
4-09		Total in coal-burning steam locomotive trains	53,800	62,445	235,591	224,759
4-10		Total in oil-burning steam locomotive trains	32,486	33,350	134,358	138,146
4-11		Total in Diesel-electric locomotive trains	165,621	149,854	651,301	596,076
12		Total car-miles per train-miles	9.52	9.26	9.51	9.38
		YARD SERVICE (DATA FROM I.C.C. M-215)				
1		Freight yard switching locomotive-hours (000):				
1-01		Steam, coal-burning	1,237	1,445	5,326	5,530
1-02		Steam, oil-burning	247	207	987	874
1-03		Diesel-electric[1]	2,895	2,393	11,453	9,205
1-06		Total	4,405	4,070	17,872	15,713
2		Passenger yard switching hours (000):				
2-01		Steam, coal-burning	50	61	211	251
2-02		Steam, oil-burning	13	12	54	51
2-03		Diesel-electric[1]	239	222	952	882
2-06		Total	337	329	1,351	1,320
3		Hours per yard locomotive-day:				
3-01		Steam	7.80	7.80	8.20	7.50
3-02		Diesel-electric	17.60	17.60	17.70	17.30
3-05		Serviceable	14.40	14.00	14.60	13.80
3-06		All locomotives (serviceable, unserviceable and stored)	12.40	11.70	12.60	11.30
4		Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.73	1.79	1.79	1.87
5		Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.78	0.77	0.77	0.80

[1] Excludes B and trailing A units.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (Total)	Cars set off between division terminals account hot boxes: System	Foreign	Total	Miles per hot box car set off between division terminals
July, 1950	2,745,932,894	—	—	23,957	114,619
Aug., 1950	2,937,455,020	7,422	15,490	22,913	128,206
Sept., 1950	2,974,297,739	6,541	12,881	19,422	153,141
Oct., 1950	3,165,997,915	4,343	8,935	13,278	238,439
Nov., 1950	2,868,871,913	2,536	5,331	7,867	364,672
Dec., 1950	2,813,042,212	2,278	5,968	8,246	341,140
Jan., 1951	2,840,847,511	2,870	8,436	11,306	251,269
Feb., 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,531

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE AUGUST ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horse-power	Service	Builder
Canadian National	3	1,200	Road	General Motors Diesel, Ltd.
Central Vermont	1	1,000	Switch	Alco-G. E.
Canadian Pacific	18[1]	1,500	Passenger and freight	General Motors Diesel, Ltd.
	10[1]	1,600	Passenger and freight	Montreal Loco. Wks.
Chicago & Eastern Illinois	4[2]	1,500	General purpose	Electro-Motive
Erie	1B[3]	1,500	Freight	Electro-Motive
	3[3]	1,500	Road switch	Electro-Motive
	4[3]	1,000	Switch	Electro-Motive
	4[3]	1,600	Road switch	Baldwin-Lima-Hamilton
	2[3]	1,600	Road switch	Alco-G. E.
	1[3]	1,000	Switch	Alco-G. E.
Missouri Pacific	18[4]	2,250	Passenger	Electro-Motive
	55[4]	1,500	Road switch	Electro-Motive
	40A & B[4]	1,500	Road freight	Alco-G. E.
	13[4]	1,000	Switch	Baldwin-Lima-Hamilton
Ontario Northland	8[5]	1,600	Road switch	Montreal Loco. Wks.
Utah	3[6]	1,600	Road switch	Alco-G. E.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	200	70-ton tank	
	150	70-ton gondola	Company shops
Canadian National	1,500	50-ton box	Canadian Car & Fdry.
	260	50-ton box	Eastern Car
	750	70-ton gondola	Eastern Car
	30	50-ton dump	Eastern Car
	5	70-ton hopper	Eastern Car
	10	30-ton stock	Eastern Car
	500	50-ton flat	National Steel Car
	750	70-ton hopper	National Steel Car
	500	50-ton refrig.	National Steel Car
	125	70-ton covered hopper	Canadian Car & Fdry.
Chicago & North Western	250[7]	70-ton covered hopper	Pullman-Standard
Chicago, Indianapolis & Louisville	250[8]	50-ton PS-1 box	Pullman-Standard
Delaware, Lackawanna & Western	100	70-ton covered hopper	American Car & Fdry.
Grand Trunk Western	250	40-ton box	American Car & Fdry.
	250	70-ton hopper	General American
Union Pacific	100[9]	Caboose	Company shops
Wabash	50[10]	70-ton gondola	Greenville Steel Car
	100[10]	70-ton covered hopper	Pullman-Standard

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Canadian National	30	Baggage	National Steel Car

[1] Delivery of the 1,500-hp. units is to begin this month. Two of the 1,600-hp. units have already been delivered. This equipment will replace Selkirk-type steam locomotives used for heavy mountain work. Among the displaced units will be locomotive No. 5935, probably, the road says, the last steam locomotive to be acquired by the C. P., being the last of an order for six delivered in 1949.

[2] Estimated cost $600,000. Two units were delivered in August. Delivery of the other two expected this month.

[3] Delivery of the Electro-Motor, units expected in February and March; the Baldwin-Lima-Hamilton units in November of this year; the Alco-G. E. units also in November, and the one switching unit in March.

[4] Delivery expected to start in January and to be completed by August, 1952. 101 units are to be radio equipped. The new diesels will permit retirement of 164 steam locomotives, according to the road's statement.

[5] Approximate cost, $1,600,000. Delivery expected early this month.

[6] Estimated cost, $630,000. Delivery scheduled for December.

[7] To cost about $1,750,000. Delivery scheduled for the second quarter of 1952.

[8] Approximate cost, $1,400,000. Delivery scheduled for the third quarter of 1952.

[9] Estimated cost $1,520,000. Delivery expected in February 1952.

[10] Delivery expected in the second quarter of 1952.

NOTES:

Grand Trunk Western.—The Grand Trunk has purchased six lightweight streamline coaches from the Chesapeake & Ohio.

Union Pacific-Chicago & North Western.—These roads are reported to be inquiring for 23 passenger cars for use in their joint services.

group, spokesmen for the T. C. said this rolling stock and motive power is for use in this country and overseas, and limited quantities will be used for a "mobilization reserve."

Herman Lemp Receives Henderson Medal

THE Franklin Institute has awarded the George R. Henderson Medal to Herman Lemp, of Ridgewood, N. J., for his contributions to the development of the diesel-electric locomotive. Formal presentation of the award, a gold medal given for meritorious inventions or discoveries in the field of railway engineering, will take place on October 17 at special ceremonies in Franklin Hall, Philadelphia.

Mr. Lemp, a naturalized citizen of the United States, was born in Berne, Switzerland, in 1862 and was educated at the Gymnasium Burgdorf College and at Neuchatel Academy. He spent three years in the Fabrique de Telegraphes et Appareils Electriques Hipp Neuchatel, and later came to this country to work in the laboratories of Thomas Edison in Menlo Park, N. J., and New York. He was an electrical engineer with Schuyler Electric Company for six years and chief engineer of the Thomson Electrical Welding Company from 1889-1895.

He was for many years affiliated with the General Electric Company both in Massachusetts and in Erie, Pa., where he developed the electrical transmission for the diesel-electric locomotive. He later became chief engineer for the Erie Steam Shovel Company and then consulting engineer of the Locomotive Department of the Ingersoll Rand Company. From 1938 to 1940 he was engaged in railroad building for the New York World's Fair.

Shale Oil for Diesels Success

A FIVE-WEEK road test in which Denver & Rio Grande Western switching locomotive No. 100 operated on diesel fuel made from shale oil in the Bureau of Mines' oil-shale demonstration plant near Rifle, Colo., has been pronounced a complete success by E. A. Perlman, general manager of the road, and J. H. East, Jr., regional director of the bureau.

The shale oil product performed as well as standard diesel petroleum fuel normally used by railroads, Mr. Perlman and Mr. East said, and inspection of the engine after the test disclosed only normal wear and carbon deposition. A small amount of gum was found on the filters, but this can be eliminated in the refining stage, according to members of the bureau's refining staff at Rifle.

The experiment was made under a cooperative agreement between the Rio Grande and the bureau, with the former supplying a 1,000-hp. 12-cylindr diesel unit and the bureau providing 5,180 gal. of fuel oil. The first limited test of shale oil diesel fuel in a locomotive took place on September 1, 1950, when the Rio Grande's "Prospector" made a successful run from Salt Lake City to Denver. Further tests are under consideration.

Freight-Car Program Cut Expected

THE National Production Authority has announced that allotments of steel, copper and aluminum in the fourth quarter of this year will cut freight car production by as much as 10 per cent in the first three months of 1952.

On the basis of planned allotments to the railroad industry in the fourth quarter, there will be material sufficient for construction of 24,500 freight cars and 2,500 tank cars in the first quarter of 1952, the agency said. The announcement also said that a "very substantial cut" in the amount of maintenance, repair and operating supplies is "considered probable" in the first quarter of next year.

This announcement by N.P.A. followed a meeting with members of the agency's Railroad and Railroad Contract Car Builders Committees.

According to N.P.A., members of the Railroad Advisory Committee protested the tentative decision to allocate steel first for the car-building program and then to allot the remainder for MRO supplies. This committee asked that MRO be given first priority.

Acceptance of this change, N.P.A. said, would reduce the freight car program to about 10,000 cars a quarter.

The Contract Car Builders Committee was critical of this recommendation that MRO supplies be given top priority, N.P.A. said. They warned that such a move would

"demoralize" the building industry, and said the heavy cut in production would increase the cost per car by from $1,000 to $2,000.

The agency said both railroad and car builder representatives agreed on the need for 10,000 new freight cars a month, but N.P.A. maintained that demands for steel allotments in the fourth quarter already range "from 125 per cent to 600 per cent of anticipated supply."

Following this freight car announcement, N.P.A. issued a similar statement with respect to locomotives. These, too, will be cut back in the first quarter of 1952, and production is now estimated at 750 for the three-month period. In the fourth quarter of this year, 825 locomotives are scheduled for production.

SUPPLY TRADE NOTES

UNITED STATES STEEL COMPANY.—*Albert R. Pfeltz, Jr.*, assistant to the sales manager, New York district, United States Steel Company, has been appointed assistant sales manager in the Cincinnati district sales office.

◆

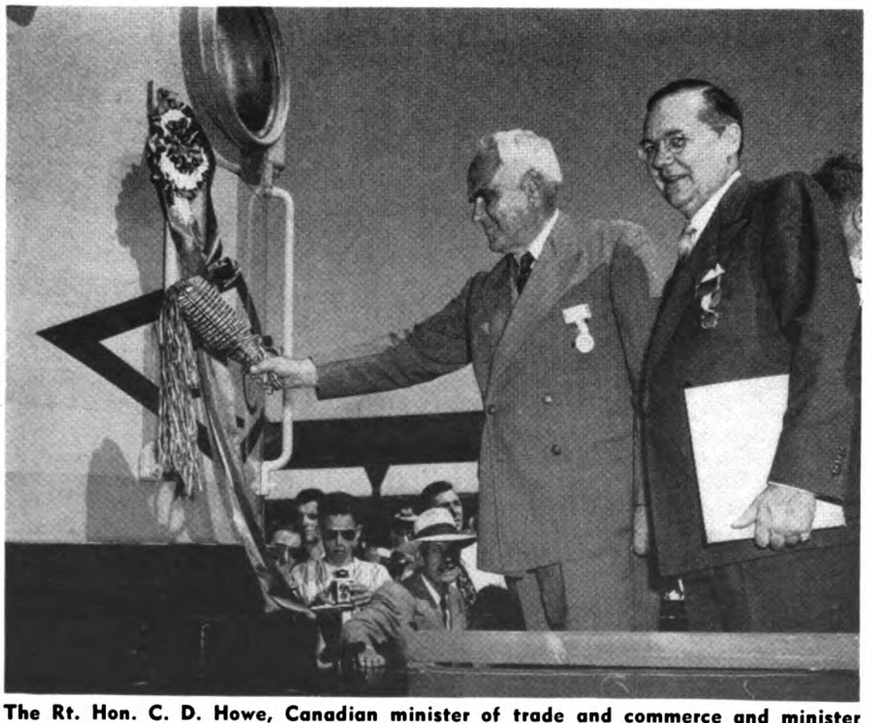
CANADIAN LOCOMOTIVE COMPANY.—The first units of the Consolidation Line locomotives to be produced at the Kingston, Ont., plant of the Canadian Locomotive Company were dedicated at ceremonies at Kingston on August 1. Upwards of $2,000,000 is to be spent in modernization and plant equipment to produce the Fairbanks-Morse opposed-piston diesel engines and assemble the completed locomotives. By the end of this year it is expected that the plant's capacity for diesel-electric locomotive production will be in excess of the 16 locomotives a day which were built when the plant was turning out steam power. The increased facilities at the Kingston plant are for the production of diesel switchers and industrial locomotives as well as road power. The units dedicated on August 1 are the Canadian prototype of the Consolidation, or C-Line locomotives, in which packaged units can be combined to produce 78 different locomotive combinations with one standard car body. The Consolidation line ranges from 1,600 to 9,600 hp. and are adapted to all classes of service.

◆

ALUMINUM COMPANY OF AMERICA.—A new aluminum smelting plant, said to be the first in history to use lignite (subbituminous coal) for fuel will be built by the Aluminum Company of America. Application has been filed to begin construction of the plant in the immediate future at one of several alternate locations approximately 60 miles south of Waco, Tex. Production of metal is expected to start in the early fall of 1952, with a capacity of 85,000 tons of aluminum annually.

◆

NIAGARA MACHINE & TOOL WORKS.—The Niagara Machine & Tool Works has moved its offices from the General Motors Building to 15484 James Couzens Highway, Buffalo.



The Rt. Hon. C. D. Howe, Canadian minister of trade and commerce and minister of defense production, to the left of Robert H. Morse, Jr., president both of the Canadian Locomotive Company and Fairbanks, Morse & Co., christening the first 3,200-hp. two-unit locomotive, the "City of Kingston," to leave the Kingston plant

LANDIS TOOL COMPANY. *J. S. Mourer* has been appointed manager of the new office of Landis at 4140 Brownsville Road, Pittsburgh 27. Mr. Mourer previously worked in the Chicago area.

◆

LINCOLN ENGINEERING COMPANY.—*John E. Renner* has been appoined general sales manager of Lincoln Engineering.

◆

ESSO STANDARD OIL COMPANY.—*E. W. Ball*, railroad sales engineer of Esso, has been appointed assistant manager of the railroad sales division of the company. Mr. Ball became associated with the company in 1942. Prior to that he had been supervisor of auxiliary equipment of the New Haven.

◆

AMERICAN CAR & FOUNDRY CO.—*William M. Hawkins*, formerly laboratory director for the American Car & Foundry Co., at Berwick, Pa., has been appointed senior research engineer at New York, in the research and development department.

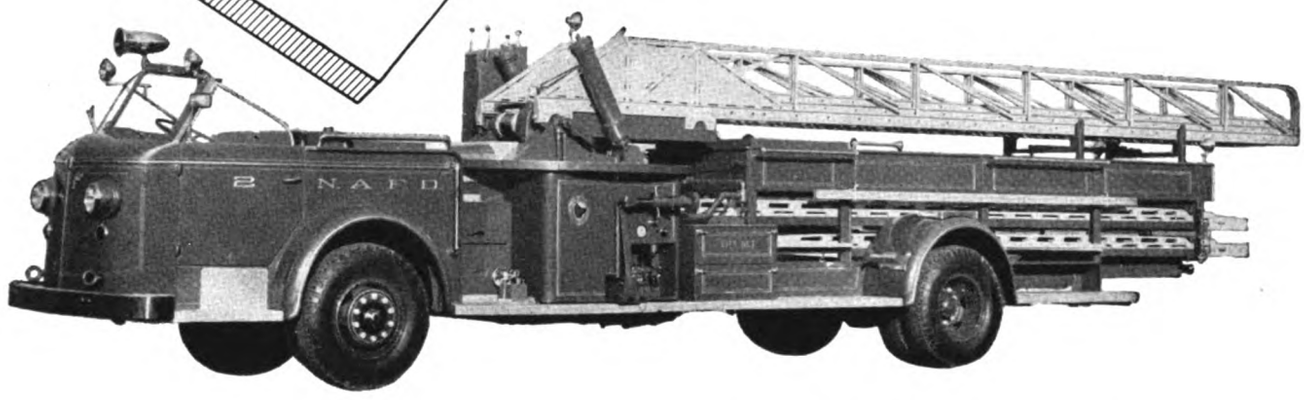
◆

CUMMINS ENGINE COMPANY.—*Robert E. Huthsteiner* has been elected president of the Cummins Engine Company, Columbus, Ind. Mr. Huthsteiner succeeds *J. Irwin Miller* who has become chairman of the board.

◆

ELECTRO-MOTIVE DIVISION.—The Electro-Motive Division of General Motors Corporation has announced the following changes in sales, service and parts personnel: *C. L. Moss*, sales representative at Washington, D. C., as district sales manager at New York; *James B. Swindell*, sales representative at Chicago, as district sales manager there; *Warren A. Thomas*, manager of statistics and market analysis section in the sales department as sales manager, LaGrange factory branch; *Harold P. Gustafson*, sales engineer at LaGrange, as sales representative at New York; *Donald S. Fricke*, district engineer, New York region, as sales representative at Washington; *Floyd E. von Ohlen*, sales engineer at LaGrange, as sales representative, Chicago region; *Norbert A. Minor*, parts representative, Chicago region, as Chicago sales representative; *Charles F. Lincoln, Jr.*, manager of the production application section of the sales department, as assistant general parts manager; *Kenneth J. Wolf*, of the product application section as Mr. Lincoln's successor; and *John F. Greenip*, service engineer at St. Louis, as parts representative for that region.

READY for *Action!*



FIRE fighting equipment must be in readiness for emergency service at all times.

Likewise steam locomotives should be maintained to meet emergency service ...they will certainly be called on

Anticipate such demands by providing the necessary replacement stock of vital parts that will be needed to recondition and to maintain them.

Check your reserve stock of parts for SUPERHEATERS, FEEDWATER HEATERS, EXHAUST STEAM INJECTORS, STEAM DRIERS, THROTTLES AND HEADER CASTINGS.

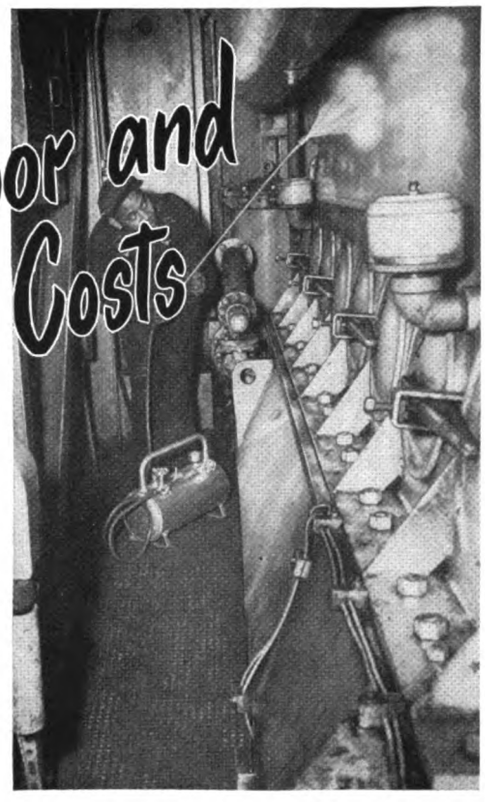
With material shortages and increased demands on our facilities, delivery schedules are lengthening. Act now... it is later than you think.

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Superheaters · Pyrometers · Injectors · Steam Driers · Feedwater Heaters · Steam Generators · Oil Separators · Welded Boiler Shells · Throttles

Save Labor and Material Costs

Cleaning Diesel Engine Interiors!



You can save $10 to $12 per diesel engine-room every time you clean. Spray on Magnusol cleaning solution . . . let soak . . . rinse off. Solution is one part Magnusol concentrate to six parts safety solvent. Use on floors and walls as well as engine surfaces. Saves hours over manual wiping.

Magnusol **takes the "cling" out of greasy dirt, wherever it is. It's wonderful for cleaning out engine pits. Use the same concentration.**

Magnusol **works just as fast and well in cleaning engine trucks and underbodies.**

Magnusol **makes the best cleaner you ever used for greasy concrete floors. And there are no fumes, no fire hazards, no toxic effects.**

Magnusol **can be used for fast, thorough cleaning of any surface with greasy, oily dirt. It's safe for all metals, painted surfaces and most materials of construction. Leaves no oily film to collect dirt.**

Give MAGNUSOL a Workout!

Order a small drum. Give Magnusol a thorough trial on any or all the jobs outlined above, or on any other greasy dirts you have trouble with. If you react like all the other railroaders who have tried it, you'll never again be without a stock of Magnusol!

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

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MAGNUS CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

CUMMINS-CHICAGO CORPORATION. — *Mitchell A. Kapland*, vice-president, has been placed in charge of sales activities of all four divisions of Cummins-Chicago, including the Portable Tool division. *R. E. Mitchell* has been been appointed field sales manager of the Portable Tool division.

◆

DEARBORN CHEMICAL COMPANY.—*C. S. White*, who has been appointed manager of the eastern division of the Dearborn Chemical Company, at New York, to replace the late Herbert J. Cornell, former



C. S. White

vice-president, eastern division, whose death is reported on another page in this issue. Mr. White was formerly manager of the eastern division water treatment department.

◆

BUDD COMPANY.—The following personnel changes have been made in the railway sales division of the Budd Company: *Thomas R. Wagner*, head of the New York office, has been appointed regional sales manager at Chicago, succeeding *John E. Wright*, resigned. *Robert A. Sherman*, formerly in charge of the St. Louis office will succeed Mr. Wagner at New York. The St. Louis office will be closed September 30 and its functions will be transferred to the Chicago office. *Percy R. Keller*, operating from general headquarters in Philadelphia, has assumed the duties of *James M. Plaskitt*, who has resigned as head of railway sales activities in Washington, D. C.

◆

WORTHINGTON PUMP & MACHINERY CORP. —*A. H. Borchardt* has been elected a vice-president of the Worthington Pump & Machinery Corp., with overall responsibility for sale of the corporation's entire line of pumping equipment, including centrifugal, reciprocating and vertical turbine pumps.

◆

ELECTRIC STORAGE BATTERY COMPANY.—The Electric Storage Battery Company has moved its general offices from its plant at 19th street and Allegheny avenue to 15th and Chestnut streets, Philadelphia. Offices concerned with engineering and manufac-

(*Continued on page 100*)

Because General Motors Diesel locomotives are designed, built and serviced by a single organization, responsibility for all phases of locomotive performance is centralized in a single source.

That accounts for a nationwide staff of field service engineers—for factory instruction of railroad operating and maintenance supervision —for strategically located factory branches and convenient parts depots—one source—one responsibility for everything—for every locomotive we've built!

ELECTRO-MOTIVE DIVISION

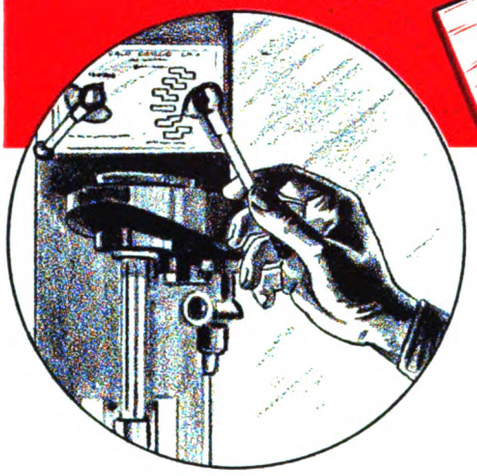
GENERAL MOTORS LOCOMOTIVES

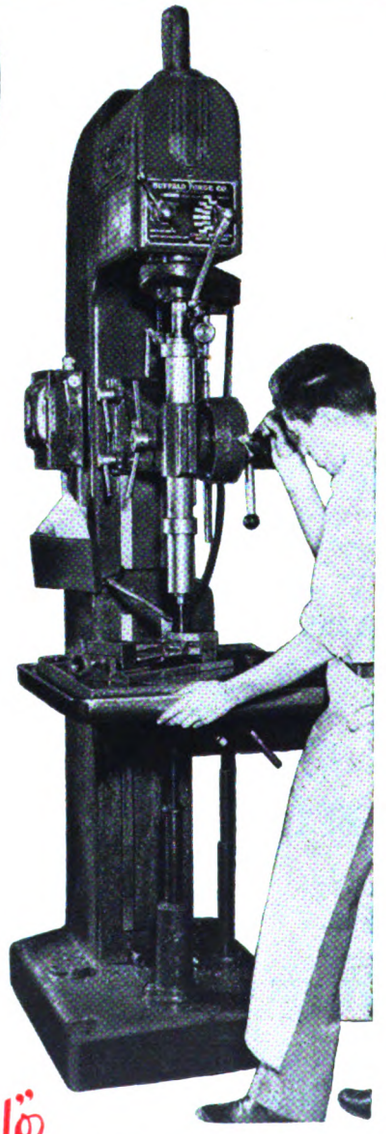
GENERAL MOTORS LA GRANGE, ILL.

Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ont.

The Speed You Need — INSTANTLY with the RPMSTER





No stopping the motor or other time-consuming adjustment — you select the proper speed for the job by moving a lever. The "Buffalo" RPMster's unique variable speed drive does the rest. Hundreds of these big 99"-high precision drills are saving money on both job and production work up to 1½" capacity in cast iron. BULLETIN 3257 has the specifications. LET US MAIL YOU A COPY.

BUFFALO "Buffalo" FORGE COMPANY

174 Mortimer St. Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

turing operations will be moved from 19th street and Allegheny avenue to the company's other Philadelphia plant, at Rising Sun and Adams avenues, when a $5,000,000 building program is completed there.

◆

CHICAGO MALLEABLE CASTINGS COMPANY.—*L. T. Hartwig* has been elected vice-president of the Chicago Malleable Castings Company.

◆

SUNROC COMPANY.—The Sunroc Company has appointed two new distributors for its electric water cooling and purifying equipment—the *Johnson Electrical Supply Company*, Cincinnati, in the Cincinnati area, and the *Crane Company*, Pittsburgh, in the Pittsburgh area.

◆

UNION ASBESTOS & RUBBER CO.—*W. H. Mowers, Jr.*, has been appointed eastern sales representative for the Union Asbestos



W. H. Mowers, Jr.

& Rubber Co., with headquarters at New York. Mr. Mowers previously served as administrative assistant in the railroad sales department at Chicago.

◆

WESTINGHOUSE AIR BRAKE COMPANY; UNION SWITCH & SIGNAL CO.—The merger of the Westinghouse Air Brake Company and its two subsidiaries, the Union Switch & Signal Co., Swissvale, Pa., and the Westinghouse Pacific Coast Air Brake Company, Emeryville, Cal., has been approved by stockholders.

◆

CHICAGO STEEL SERVICE COMPANY.—*Walter H. Creber, Jr.*, has been appointed sales manager of Chicago Steel Service, with headquarters at the company's new general offices and warehouse on Kildare avenue and 45th street, Chicago.

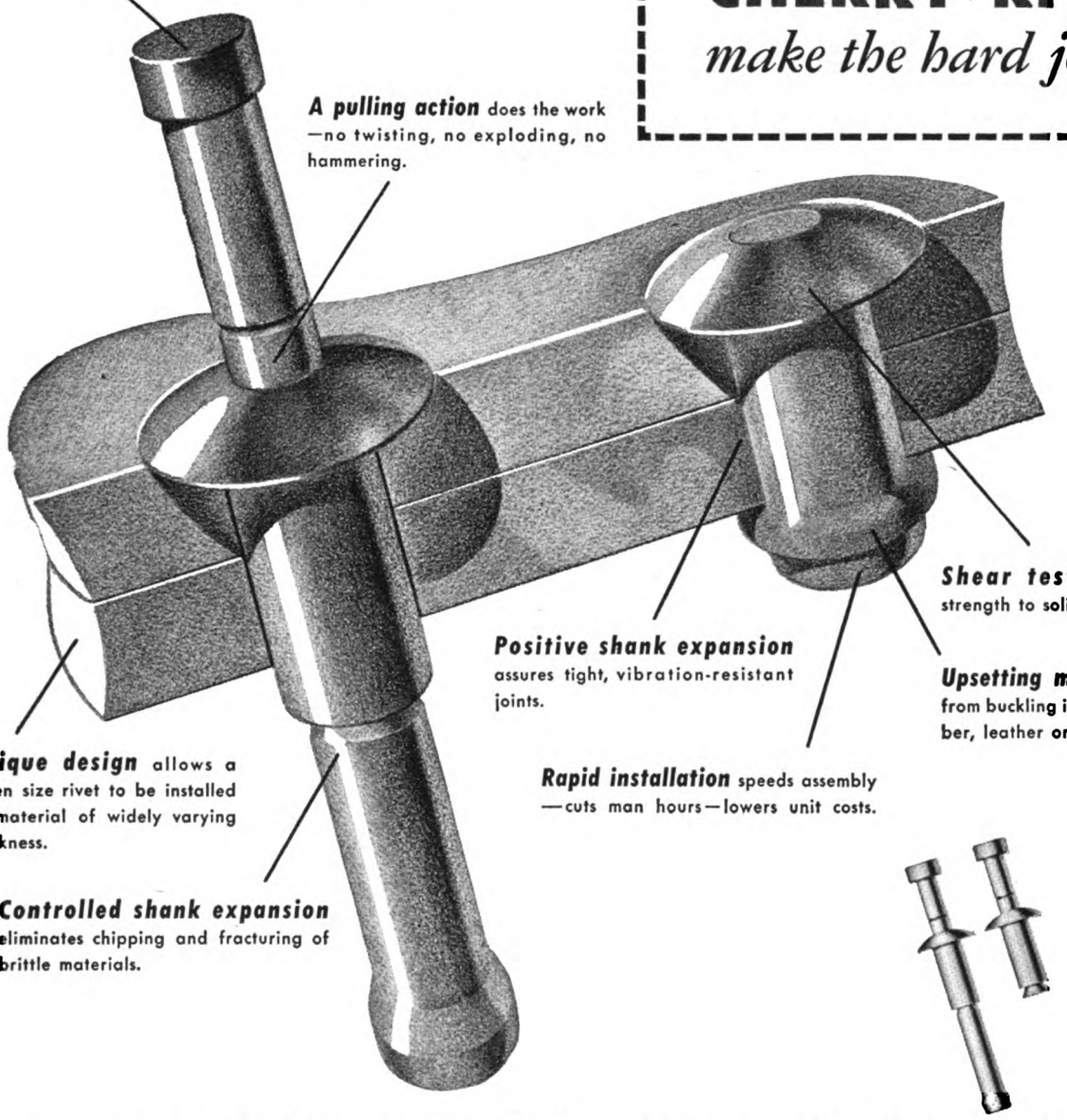
◆

CHICAGO STEEL SERVICE COMPANY.—The Chicago Steel Service Company has moved to new general offices and warehouse on Kildare avenue at 45th street, Chicago.

◆

WATSON-STILLMAN COMPANY. — *H. L. Henry*, formerly western New York state representative for the Watson-Stillman Company, Roselle, N. J., has been ap-

Here's why
CHERRY RIVETS
make the hard jobs easy



Installed by one man from one side of the job.

A pulling action does the work —no twisting, no exploding, no hammering.

Shear tests show comparable strength to solid rivets.

Positive shank expansion assures tight, vibration-resistant joints.

Upsetting method prevents shank from buckling in soft materials like rubber, leather or fabric.

Unique design allows a given size rivet to be installed in material of widely varying thickness.

Rapid installation speeds assembly —cuts man hours—lowers unit costs.

Controlled shank expansion eliminates chipping and fracturing of brittle materials.

For you, the particular value of Cherry Rivets may be the simplicity of installation. Or you may need the strength of Cherry Rivets and their vibration-resistance. But if you haven't met their money-saving advantages, take a moment today to ask for full information covering your applications.

Once you've realized the potential values in Cherry Rivets, your engineers and Cherry's can cooperate in determining the savings for your business.

Standard Cherry Rivets are available in five diameters, from 1/8" to 9/32". Special sizes manufactured on order.



Cherry Rivet
COMPANY
A Division of Townsend Company

CHERRY RIVETS ARE APPROVED BY U.S. NAVY, U.S. AIR FORCE AND CIVIL AERONAUTICS AUTHORITY. CHERRY RIVETS ARE PATENTED.

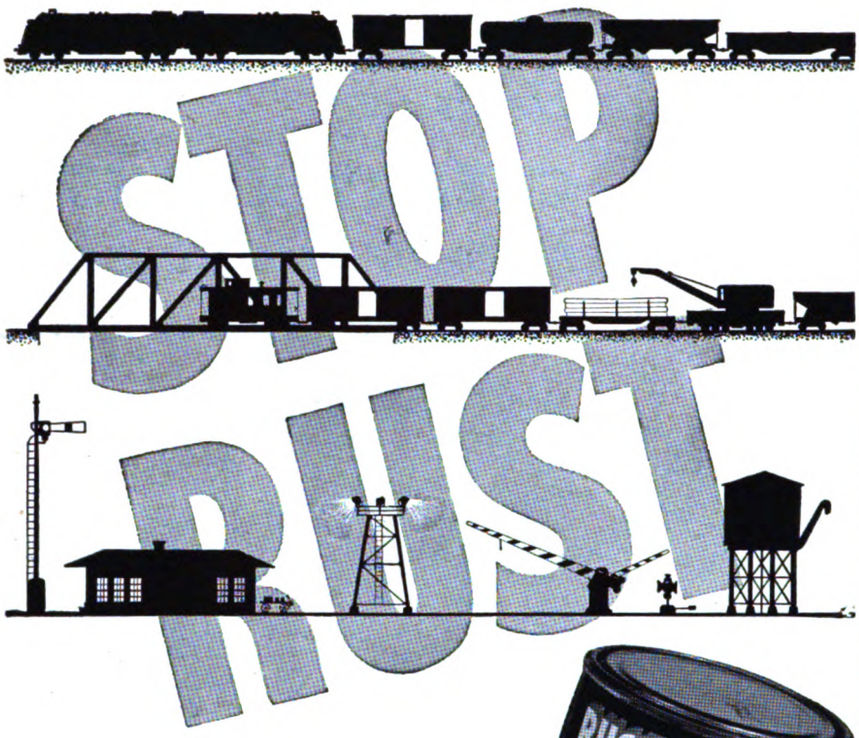
Cherry Rivet Company, Dept. I-107
231 Winston Street, Los Angeles 13, Calif.

Please send me further information describing Cherry Rivets; no obligation, of course. ☐ bulletin ☐ sample rivets

Name_____ Title_____

Firm_____ Address_____

City_____ Zone_____ State_____





Save Hard-to-Get Metals!

If They're Rustable...

You Need

RUST-OLEUM

Always a needless waste—rust is a doubly dangerous enemy now when it is difficult to obtain metal replacements. Stop the ravages of rust with RUST-OLEUM—an effective, practical means of *rust control.* RUST-OLEUM'S tough, pliable, rust-resisting film provides excellent protection to rolling stock, metal buildings, tanks, signal equipment and other railroad properties.

Proved in Railroad Use — from Coast to Coast

On major railroads, RUST-OLEUM stops rust — easily, effectively, economically and extends the useful life of all rustable metal surfaces. Applied by brush, dip, or spray, it saves time and labor on application... It can be applied *even* over metal that is already rusted. It is necessary to remove only the rust scale and loose rust with a sharp scraper and wire brush. It's the practical answer to effective rust prevention by field maintainers.





Write today for RUST-OLEUM'S new catalog of railroad applications . . . and give us the details of any troublesome rust problems you may have.

AVAILABLE IN COLORS, AND ALUMINUM.

RUST-OLEUM CORPORATION

2591 Oakton Street **Evanston, Illinois**

pointed divisional sales representative for northern Ohio, with headquarters in Akron, Ohio. The *Don W. Patterson Company*, 2016 Rand building, Buffalo, N. Y., has been appointed exclusive sales representative in western New York.

◆

UNION CARBIDE & CARBON CORP.—*Lem Adams*, vice-President of *Oxweld Railroad Service Company*, a division of Union Carbide and Carbon Corporation, has retired from active service.

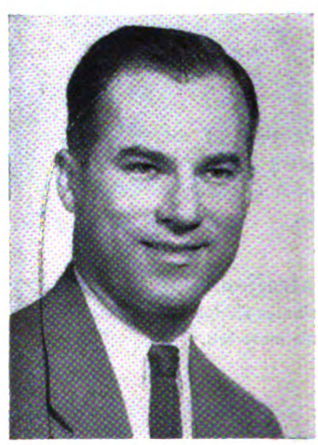
Mr. Adams, a graduate of Texas Agricultural and Mechanical College, joined Oxweld as chief engineer in 1933. He started his railroad career in 1908 on the Union Pacific where he was chief engineer at the time he resigned to join Oxweld.

◆

IRVINGTON SUBWAY GRATING COMPANY.—The Irvington Subway Grating Company, of Long Island City, N. Y., and Oakland, Calif., has appointed *Guilford S. Turner, Inc.*, of Chicago, national sales representative for freight cars and locomotives.

◆

VANADIUM CORPORATION OF AMERICA.—*T. W. Merrill* has been appointed chief metallurgical engineer of the Vanadium Corporation and has been transferred from the company's plant at Bridgeville, Pa., to headquarters in New York. Mr. Merrill, a graduate of Yale School of Engineering



T. W. Merrill

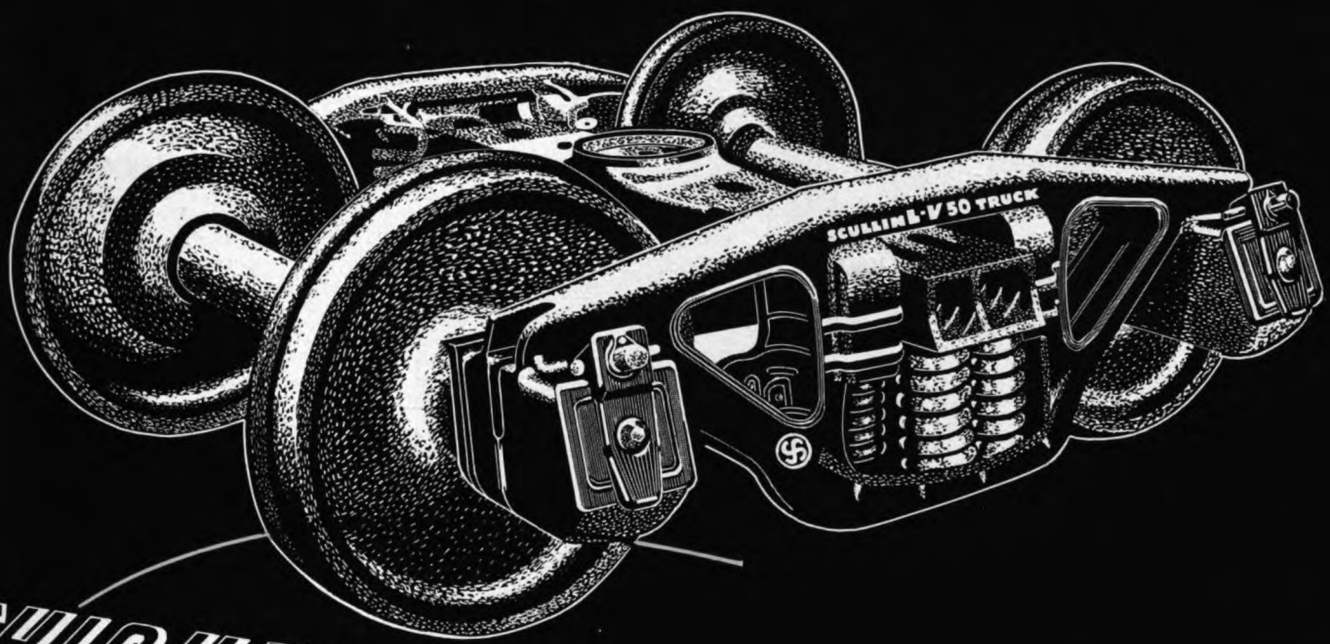
in 1936 with a B.E. degree, began his career with the United States Steel Corporation as a metallurgical observer at the Duquesne Works. In 1939 he was transferred to the research laboratory at Kearny, N. J. Two years later he became metallurgist in the employ of Vanadium at Bridgeville and in 1949 was appointed metallurgical engineer.

◆

GRAYBAR ELECTRIC COMPANY.—*W. E. Guy* has been appointed Chicago district manager of the Graybar Electric Company to succeed *G. J. Cossmann*, who has retired after more than 51 years of service.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*Hendley Blackmon* has been named manager of engineering association activities for the Westinghouse Electric Corporation. He will work with Westinghouse engineers in the preparation of papers to be pre-



"HIGHBALL!"

you're sure high speeds are safe on SCULLIN L 50 V TRUCKS

LATERAL VERTICAL CUSHIONED MOTION

THE SMOOTHEST TRAFFIC-BUILDERS BETWEEN LCL AND YOUR RAILS

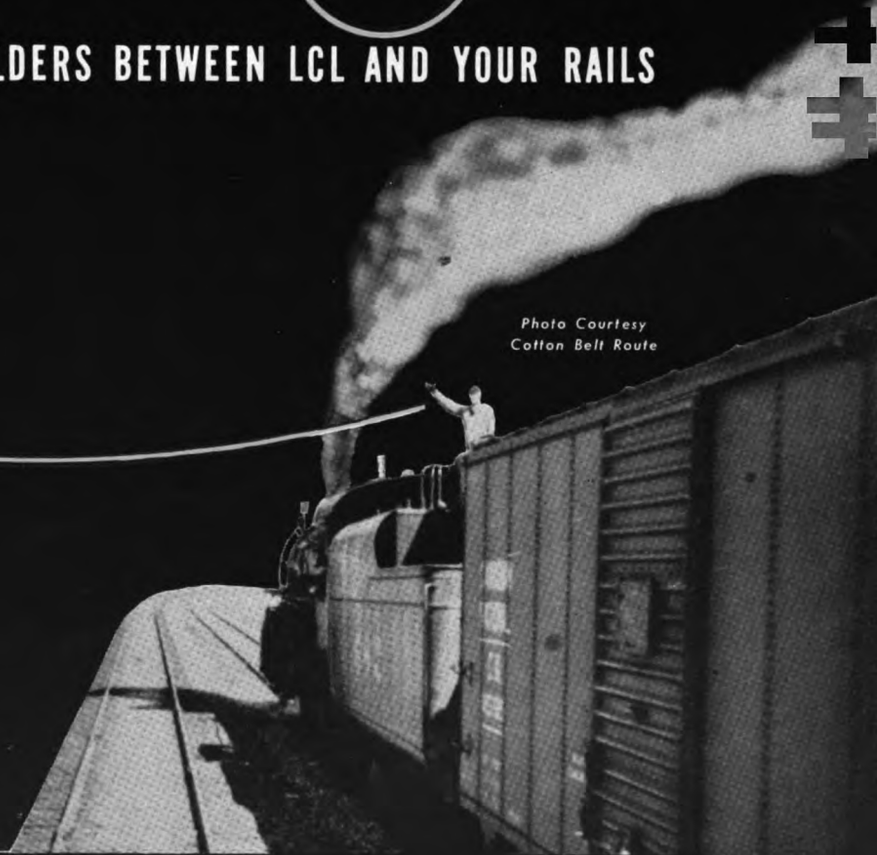


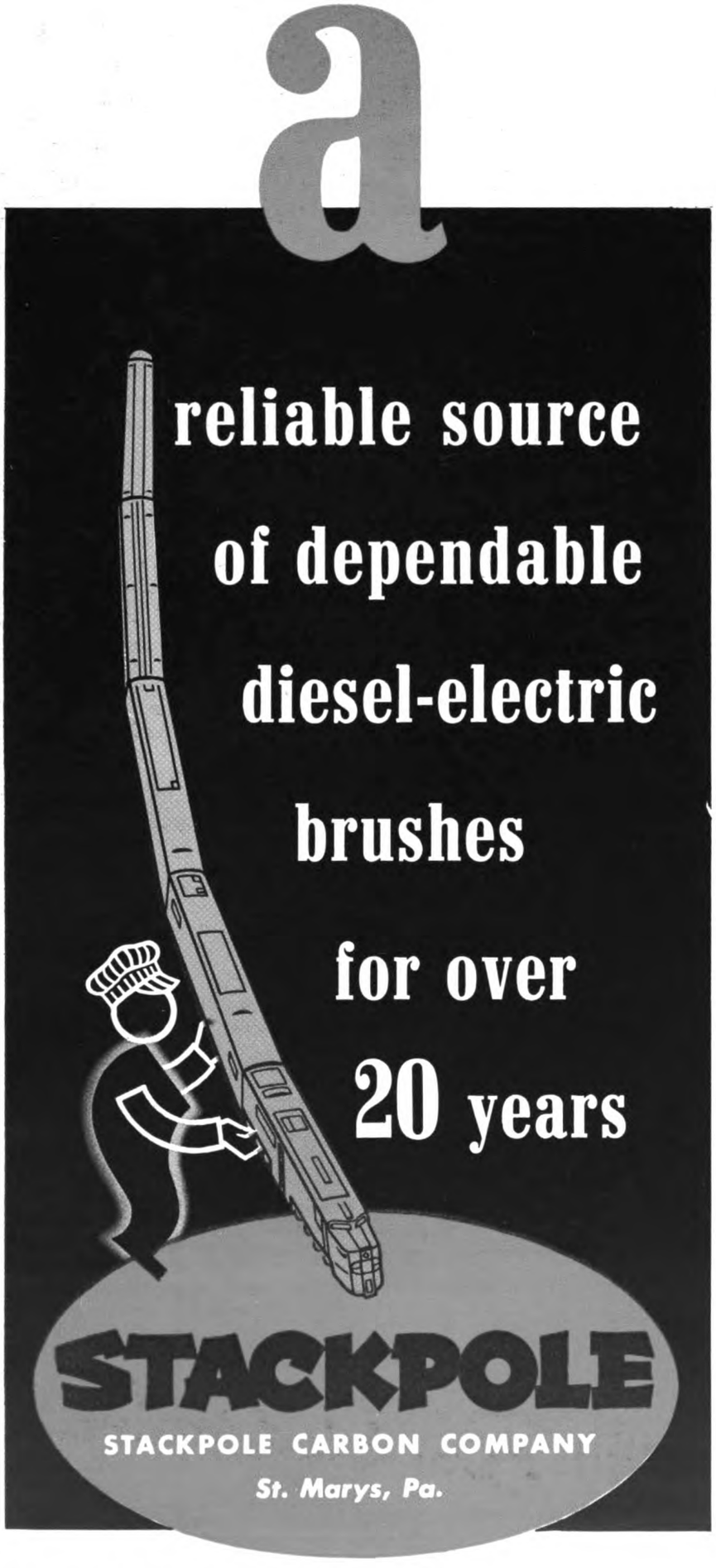
Photo Courtesy Cotton Belt Route

STEEL CASTINGS MANUFACTURER

NEW YORK
CHICAGO
BALTIMORE
RICHMOND, VA.

SCULLIN STEEL CO.

SAINT LOUIS 10, MISSOURI



sented before engineering association meetings. Mr. Blackmon, who has served as assistant manager of the activity since 1949, succeeds *Frank Thornton, Jr.*, who recently retired.

◆

ALLIED STEEL CASTINGS COMPANY.—*J. T. Llewellyn, II*, and *L. J. Wise* have been elected respectively, president and vice-president of the Allied Steel Castings Company, Chicago and L. F. Hartwig will assume the title of assistant to the president.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*Richard P. Carroll* has been appointed production control manager for Hunt Spiller at Boston, Mass., and will continue in charge of cost and materials controls.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*John P. Kelleher* has been appointed assistant sales manager of the Chicago works of National Malleable & Steel Castings Co.

Mr. Kelleher became associated with the company at Chicago in 1941 in its Cost and Accounting department at Chicago from 1941 until 1943, when he first entered sales work. He has been in the Chicago sales department since 1943.

National Malleable will build a new physical testing laboratory for railway engineering development work in Cleveland, according to the company's president, Cleve H. Pomeroy. The engineering laboratory will cost $750,000. The buildings and test tracks will occupy about five acres of land. Research on car couplers will be continued and expanded with the new facilities. Among other railroad equipment items which will be studied, tested and developed at the laboratory are rubber and friction-type draft gears for freight and

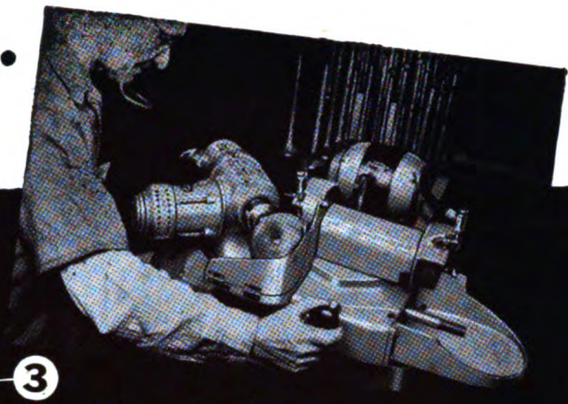


J. P. Kelleher

passenger cars and motive power equipment, freight car trucks, journal boxes and journal box lids, as well as similar devices for the mine and industrial fields. *Kenneth L. Selby*, chief engineer of National's railway division, will direct the activities of the laboratory.

The main laboratory building will have a 1,000,000-lb. static test machine, a 27,000-lb. drop test machine, fatigue and angling machines and much other physical laboratory equipment. The test tracks, which will be about 1,400 ft. long, will extend partly

CLOSE-UP of B&D No. 6 Universal Valve and Tool Grinder shows clean, gadget-free design—conveniently placed controls—clear visibility of workpiece.





Here's why BLACK & DECKER No.6 Universal Valve and Tool Grinders save you TIME and MONEY on valve grinding!

THESE 5 EXCLUSIVE FEATURES on the B&D No. 6 Grinder give you faster, more accurate valve grinding. They produce better finishes—free from chatter marks. They eliminate costly regrinding or scrapping of valves.

This B&D No. 6 Grinder . . . refaces diesel valves up to 5¼" head diameter. Also handles small gasoline engine valves and a host of other jobs. The work-head chuck stems from ¼" to 1¼" and rotates for 0° to 90° grinding. It's ideal for grinding tappets, rocker arms, valve stems. And you can quickly convert it for tool grinding. Let your nearby B&D Distributor show you the Black & Decker No. 6 Universal Valve and Tool Grinder's advanced features. Call him today—or write for detailed booklet to: The Black & Decker Mfg. Co., 665 Pennsylvania Ave., Towson 4, Maryland.

1. **HYPOID GEAR DRIVE** on work-head spindle insures extremely smooth operation and mirror-finish valve faces.
2. **AIR-OPERATED WORK-HEAD CHUCK** gives speedy opening and closing of valve stem collets, accurate centering of every valve.
3. **PRECISION-GROUND FEED SCREWS** are bearing mounted for fast, smooth travel of wheel-head and work-head. Wheel-head feed screw is calibrated in thousandths for close tolerance grinding.
4. **SEPARATE UNIVERSAL MOTOR** drives work-head at controlled speeds to produce best grinding conditions for either large or small valve heads. Automatic motor cut-off controlled by table travel.
5. **SEPARATE ¾ HP CONSTANT SPEED MOTOR** assures abundant power and proper speed for 6" grinding wheels or cup wheels.

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS



Lord Mountings cushion road shock, reduce noise, protect the smooth functioning of equipment, reduce maintenance costs, add to the comfort and satisfaction of the traveling public.

When you plan new locomotives, new passenger cars, new auxiliary equipment be sure that Lord Mountings are in the drawings and the specifications . . . make them a part of design. No other expenditure you can make will bring as great returns from so small an outlay. Here are some of the places where Lord Mountings will serve you profitably:

- **Relay Panelboards**
- **Wheel-driven Generators**
- **Fans**
- **Vestibule Diaphragms**
- **Air Conditioning Units**
- **Power-driven Generators**
- **Signal Equipment**
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Write for your copy of the Lord Natural Frequency Chart and of the Vibration Isolation Chart. Designers and engineers will find them of definite value.

Although defense production is putting a heavy demand on our facilities, LORD will make every effort to supply industrial needs.

LORD MANUFACTURING COMPANY • ERIE, PA.

Canadian Representative, Railway & Power Engineering Corp. Ltd.

LORD BONDED RUBBER — *Vibration-Control Mountings . . . Bonded-Rubber Parts*

inside the building so that railroad cars can be brought under cover for the installation of new devices. The track inspection pit will also be under cover. Outside the building both straight and curved stretches of track will be laid. The straight portions will allow car speeds up to 22 m.p.h.

A feature of the installation will be two specially built railroad cars, equipped with a large amount of electronic equipment and instruments of special design for testing car attachments. The test tracks will connect with outside railroad lines. The cars will also be used to display and demonstrate full size models of devices to the railroad men.

It is intended to expand new product development engineering into other lines such as automotive, truck, etc.

◆

IRVINGTON VARNISH & INSULATOR CO.—The *Franklin Railway Supply Company*, 60 East 42nd Street, New York, has been appointed exclusive representatives in the railroad field for the Irvington Varnish & Insulator Co., Irvington, N. J.

◆

NATIONAL BRAKE COMPANY—The *St. Louis Railway Supply Company*, 2114 North 2nd Street, St. Louis 6, has been appointed representative of National Brake in the railroad district centered in St. Louis. *Frank E. Ross, Jr.*, and *Robert M. Close* are in charge of this district.



F. E. Ross, Jr.



R. M. Close

More than 37 Railroads*



now using the new SAFE-N-EZY Filter WASHER-OILER TO PIN DOWN MAINTENANCE COSTS AT KEY SERVICE POINTS

*

Alabama Great Southern R.R. Co.	Kansas City Southern Ry.
Atlantic Coast Line (4)	Louisville & Nashville R.R.
Baltimore & Ohio Rd. (9)	Minneapolis, St. Paul & S. Ste Marie
Bessemer & Lake Erie	Missouri-Kansas-Texas Lines
Central of Georgia (2)	Missouri Pacific R.R. (2)
Charleston & Western Carolina	Nashville, Chattanooga & St. Louis
Chicago & North Western Ry. (4)	New York Central R.R.
Chicago, Burlington & Quincy Rd. (5)	New York, New Haven & Hartford Rd.
	New Orleans & North Eastern
Chicago, St. Paul, Minneapolis & Omaha Ry.	Ontario Northland Ry.
	Pennsylvania Rd. (4)
Cincinnati, New Orleans & Texas Pacific	St. Louis-San Francisco Ry. (5)
	St. Louis Southwestern Ry.
Cincinnati Union Terminal	Seaboard Air Line
Conemaugh & Black Lick R.R.	Texas & Pacific Ry.
Delaware & Hudson	Union Pacific Rd.
Florida East Coast Ry.	Wabash Rd.
Fort Worth & Denver City	Washington Terminal (2)
Great Northern (2)	Western Pacific
Illinois Central Rd.	Commonwealth Railways (Foreign)



More and more railroads are installing a SAFE-N-EZY Air Filter WASHER-OILER at every key service point — your proof of its acceptance and value as a faster, more efficient, less expensive method of air filter maintenance. So why not get all the details on this amazing new piece of equipment now and join this growing list of progressive railroads?

Investment Quickly Amortized

through tremendous savings on filter maintenance

Here's Why:

1. FAST AND THOROUGH —
Cleans, dries, and oils standard size permanent type locomotive or passenger car air filters in one handling . . . at high speed!

2. COMPACT —
A complete packaged unit. Occupies floor area of only 6'10" x 4'6". Permits convenient installation in existing service plants.

3. REDUCES FILTER INVENTORY —
Filters can be cleaned and oiled during turn-around time. Makes possible substantial reduction in filters stocked for each unit in service.

4. SIMPLE, ONE-MAN OPERATION —
Requires no special skill or training. Lets one man do more work in less time and with greater ease than ever before.

WRITE TODAY TO DEPT. RM

PAXTON-MITCHELL CO.
P-M OMAHA 5, NEBRASKA

Railway Supplies — Specialty Appliances, Tools and Parts for Locomotives and cars including: SELF-SEALING QD COUPLINGS • SAFE-N-EZY VALVE SPRING DEPRESSORS • BINGHAM CRANKSHAFT SLEEVING PROCESS • SAFE-N-EZY BELT CUTTERS • P-M METALLIC PACKING • SAFE-N-EZY FILTER WASHER-OILER • PAXMITE IRON CASTINGS • SAFE-N-EZY PRESSURE DETECTORS • WILLIAMS GRIP TRACTION MOTOR TERMINAL BLOCKS.

Two years of testing have indicated . . .

when you **STOP** axle movement

you **STOP** bearing displacement

therefore **STOP** HOT BOX TROUBLE!

with



Tough, oil-impervious, shock-resistant Neoprene permanently and *inseparably* bonded to steel inserts (dotted lines). Placed in dust-guard well, the *Axle-Stop* restricts journal movement to ⅛ inch!

Here's new **engineered** precision in journal box assembly that promises the first **real** relief from hot box troubles!

Restriction of journal movement is the answer. **Axle-Stop** has had 312,000 miles of service which bears out laboratory and motion-picture findings—that **prevention of axle displacement reduces waste grab, the most common cause of hot boxes!**

axle stop



AXLE-STOP, INCORPORATED

1830 N. Sheffield Avenue, Chicago 14, Illinois

SPRING PACKING CORPORATION.—*W. H. Russell*, vice-president of Spring Packing Corporation, at Chicago, has been appointed vice-president in charge of railroad sales. Mr. Russell, who was born in Clinton, Ill., July 7, 1912, is a graduate of the University of Illinois (1934). He served in the traffic department of the Illinois Central until 1936, when he became a



W. H. Russell

sales representative for the American Locomotive Company at Cleveland. He was appointed acting district sales manager in 1942 and two years later became Southwestern district manager, for the Baldwin Locomotive Works at St. Louis, In 1948 he joined the Spring Packing Corporation as vice-president.

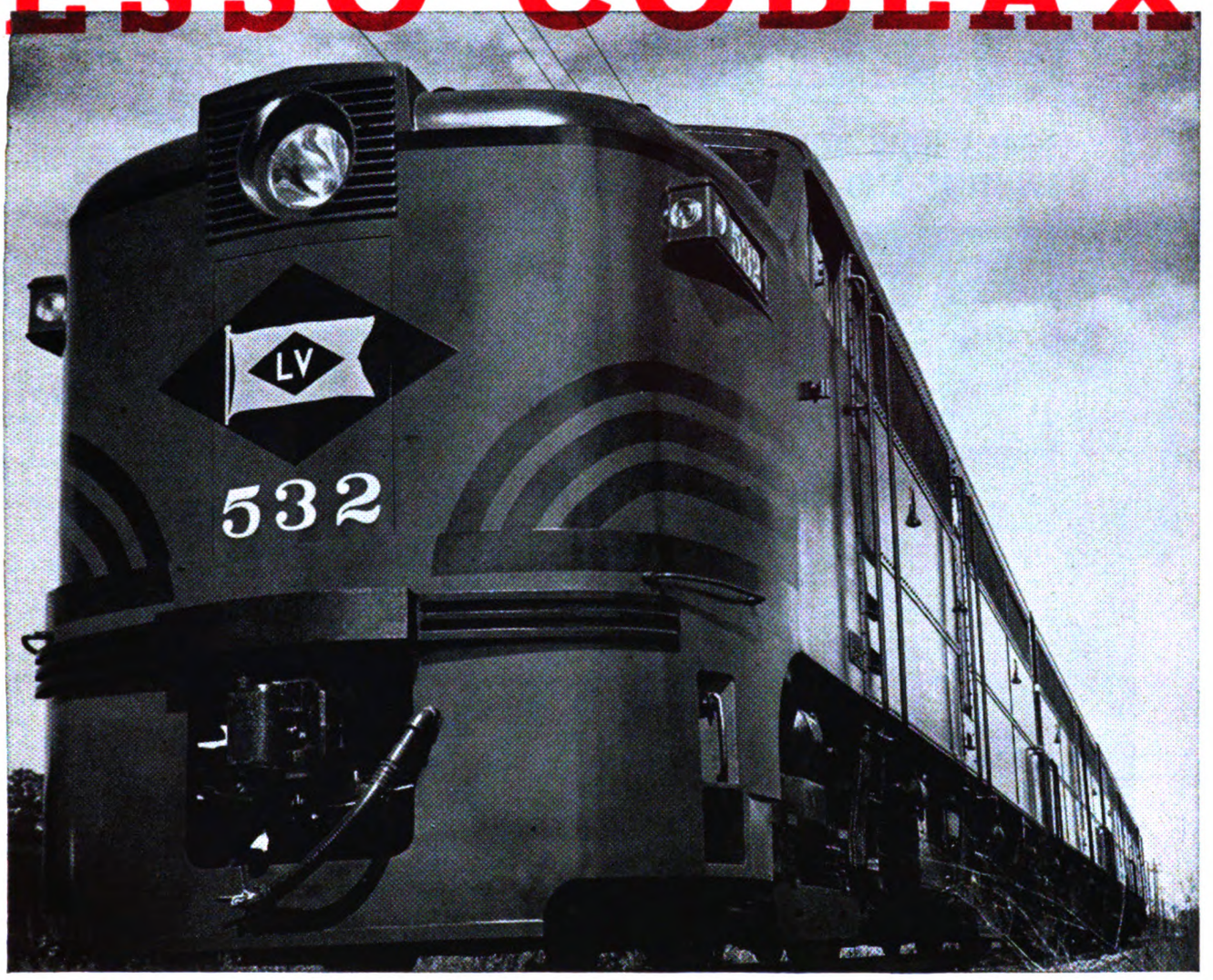
◆

P. A. MCGEE has opened an office at 30 Broad street, New York 4, as a consulting transportation engineer, specializing in economic, operating and maintenance problems related to railroad motive power. Mr. McGee, who until recently was assistant manager, Eastern Region, of the Electro-Motive Division, General Motors Corporation, at New York, was born in Ardee County South, Ireland, on March 12, 1892. He attended Clongoes Wood College, Ireland, and the London School of Science and Technology and began his career in 1909 as a student engineer, street railways, London County Council. He took the test course of the General Electric Company here in America from 1910 to 1911, and then became electrification inspector on the New York, New Haven & Hartford. From 1914 to 1919 he was resident engineer on suburban electrification at Melbourne, Australia, for Merz & McLellan, consulting engineers. He became general engineer on railway electrification for the Westinghouse Electric & Manufacturing Company (now the Westinghouse Electric Corporation) in 1920; assistant electrical engineer for the Reading in 1931, and in 1937 assistant manager, Eastern Region, Electro-Motive Division. Mr. McGee is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the Franklin Institute.

◆

DEVILBISS COMPANY.—*W. C. Spruce*, direct factory representative of the DeVilbiss Company's spray painting and finishing equipment division, has been appointed southwest district manager. Mr. Spruce will

ESSO COBLAX



"Tailor-made" to railroad specifications

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

ESSO COBLAX LUBRICANTS

have been specifically developed to provide highly dependable gear lubrication for traction motor drives on electric and diesel-electric locomotives; gas electric and multiple-unit cars; and many other locomotive and car lubrication requirements. Esso COBLAX is availabe in a wide range from fluid oils to semi-solid products... "tailor-made" for railroad applications.

BACKED BY CONSTANT RESEARCH

—keeping pace with latest engine design and developments. Esso Railroad Products are constantly being tested and improved.

BACKED BY CONSTANT FOLLOW-UP

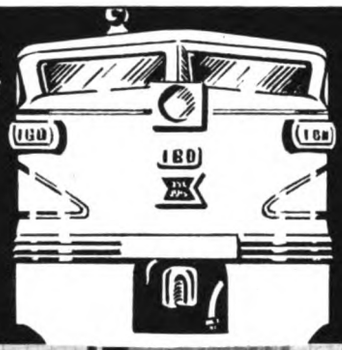
—on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any fuel or lubricating problem.

PHILLIPS

HERE'S HOW YOU CAN CUT DIESEL DOWNTIME AND MAINTENANCE COSTS!

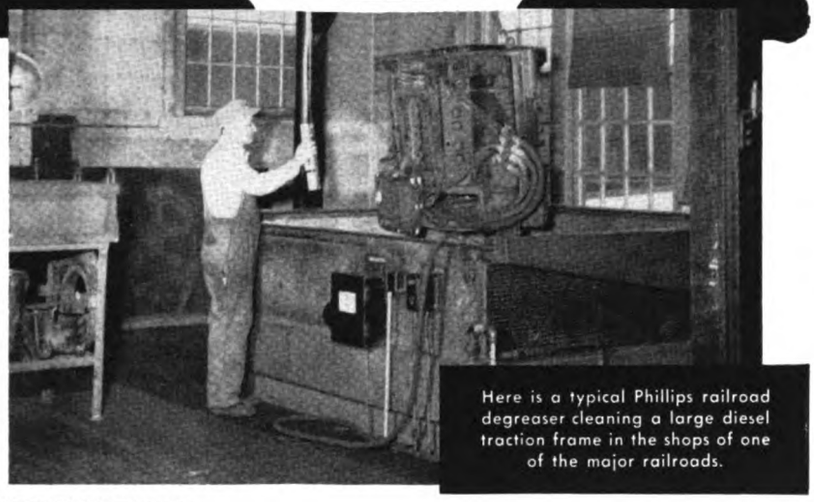
HIGHEST MEGOHM RATINGS WITHOUT OVEN DRYING

IMMEDIATE DRYING OF ELECTRICAL PARTS



NO OVEN DRYING BEFORE IMPREGNATING

NO MORE COSTLY HAND CLEANING



Here is a typical Phillips railroad degreaser cleaning a large diesel traction frame in the shops of one of the major railroads.

PHILLIPS VAPOR DEGREASING WILL CLEAN TRACTION FRAMES IN 7 MINUTES... ...ARMATURES IN 3 MINUTES

Your diesel servicing can't be any faster than the fastest parts cleaning facilities you have in your plant. This fact alone makes fast, efficient vapor degreasing a must for effective diesel service. Phillips railway degreasers can give you faster, more thorough cleaning of traction frames, armatures and crater compound laden component parts because Phillips engineers them right into your service system. There is no interruption of work flow. You get completely grease-free parts that dry off quickly for the next operation. Normal cleaning cycles will not undermine insulating varnishes. High solvent recovery and low power consumption afford economical operation. Phillips railway vapor degreasing systems are made in any size to fit your exact requirements. Write today for complete details.

SEND FOR THIS NEW CATALOG ➔

Interesting, illustrated bulletin describing Phillips' complete line of degreasing equipment.



ENGINEERED SERVICE

Phillips 3471 TOUHY AVENUE • CHICAGO 45, ILLINOIS
MANUFACTURING COMPANY
ENGINEERED METAL CLEANING EQUIPMENT

continue to maintain offices at the DeVilbiss Company's branch, 1515 Dragon St., Dallas, Tex., and will supervise the company's sales activities in the newly created southwest district which includes Texas, Louisiana, Mississippi, Arkansas, Oklahoma, New Mexico, a section of western Tennessee and northwestern Alabama.

◆

WALL COLMONOY CORPORATION.—*Henry L. Howard* has been appointed manager of a new branch office at 5815 Clinton Drive, Houston 1.

◆

IRVINGTON VARNISH AND INSULATING COMPANY—*E. A. Freiburger*, formerly sales service manager, has been named general sales manager of the Coating Division of Irvington Varnish. Mr. Freiburger will be in charge of all sales activities for the Coating Division, including market research and sales promotion with the exception of cable insulation sales. *Jean H. Rooney* has been appointed to sales service manager, succeeding Mr. Freiburger, and *James D. Smith* has been appointed varnish sales manager.

◆

HELI-COIL CORPORATION.—The Heli-Coil Corporation, Long Island City, N. Y., has moved to a new plant in Danbury, Conn.

◆

WORTHINGTON PUMP & MACHINERY CORP.—*V. de P. Gerbereux* has been appointed manager of the Centrifugal Pump Sales division of Worthington, succeeding *A. H. Borchardt* who has recently been elected vice-president in charge of centrifugal, reciprocating and vertical turbine pump sales.

◆

PITTSBURGH SCREW & BOLT CORP.—*William N. Hoelzel*, assistant manager railroad sales of the Gary Screw and Bolt division of Pittsburgh Screw & Bolt, has been appointed manager railroad sales. John C. Jewett succeeds Mr. Hoelzel as assistant manager railroad sales.

Obituary

DAVID J. JONES, executive sales representative of the Vapor Heating Corporation, Chicago, died on August 14.

◆

ALFRED G. YORK, a director and vice-president of the Watson-Stillman Company, Roselle, N. J., died on July 22, after a prolonged illness.

◆

ARTHUR F. PITKIN, retired engineer for the American Locomotive Company died on July 9 in his home at Northport, Long Island, N. Y. Mr. Pitkin was 69 years old.

◆

CARL W. BENZ, executive vice-president of the International Railway Car & Equipment Manufacturing Co., died on July 15, after a brief illness.

◆

HERBERT J. CORNELL, 61, vice-president of the Dearborn Chemical Company, eastern division, of New York, died on July 13, in the White Plains, N. Y., Hospital.

◆

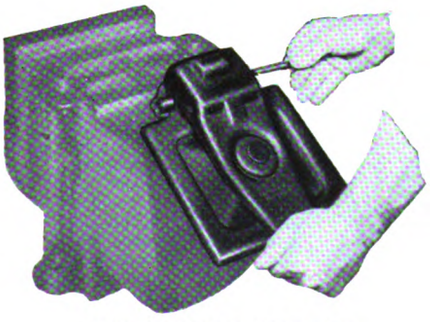
HARRY S. C. FOLK, formerly eastern railroad sales manager for the Automatic Transportation Company, died on July 18.

MOTOR WHEEL Deep Flange JOURNAL BOX LIDS



1. Hinge-pin supported by ¾" lid bearings. Worn holes and hinge-pin scoring eliminated.
2. Stops hold straight hinge-pin in position under spring pressure. NO TOOLS NEEDED TO INSERT OR SECURE HINGE-PIN.
3. Keeper-pin holds assembly during storage. After hinge-pin is inserted, hand pressure permits removal of keeper-pin WITHOUT USE OF TOOLS.
4. Coil spring and roller assembly, held snugly by sheared ears, lets lid open and close easily without wear on journal box lug.
5. Oil-tight center construction permits full articulation up, down, left and right to insure a tight fit.
6. Full pressed steel construction, 3/16" in housing and 5/32" in cover.
7. Opens 120° for easy access to journal.
8. Extended housing arm eliminates opening and closing strain on articulating point.

Give You 8 Superior Features plus Added Protection



NO TOOLS NEEDED

Neither the standard flange Motor Wheel Journal Box Lid illustrated above nor the Deep Flange model requires the use of tools to attach or detach.

The Deep Flange provides added protection from wind currents carrying foreign matter and moisture so harmful to efficient lubrication. Laboratory and field tests, plus the experience of thousands of lids in use, have proven the merits of the Deep Flange design.

NATIONAL RAILWAY SALES REPRESENTATIVE

T-Z RAILWAY EQUIPMENT CO.

8 S. Michigan Ave. Chicago 3, Ill.

MOTOR WHEEL CORPORATION

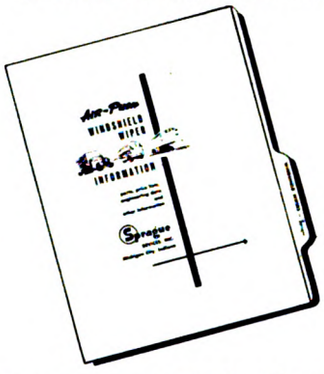
LANSING 3, MICHIGAN, U.S.A.

it's Easy!

TO SERVICE YOUR

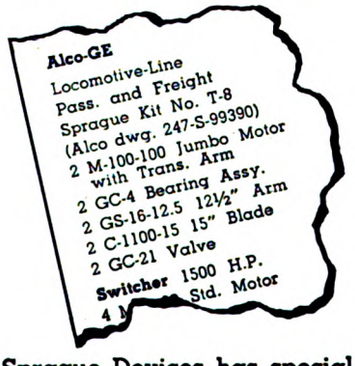
AIR-PUSH

WINDSHIELD WIPING EQUIPMENT WITH THIS NEW SERVICE CATALOG!



You can now quickly identify any wiper part by make and model of locomotive.

Here's a typical example:



Sprague Devices has specialized in the design and manufacture of dependable Air-Push windshield wipers for over 22 years. Today Air-Push is serving faithfully on over 85% of our modern diesel locomotives.

Send for the new AIR-PUSH Service Catalog Today . . . *its information will help keep your equipment operating at top efficiency.*

Sprague

DEVICES, INC.

Michigan City, Indiana

MANUFACTURERS OF THE FAMOUS

AIR-PUSH WINDSHIELD WIPERS

PERSONAL MENTION

General

O. R. PENDY, master mechanic of the New York, Chicago & St. Louis at Conneaut, Ohio, has been appointed chief mechanical officer at Cleveland. Mr. Pendy received his railway mechanical engineering degree from Pennsylvania State College



O. R. Pendy

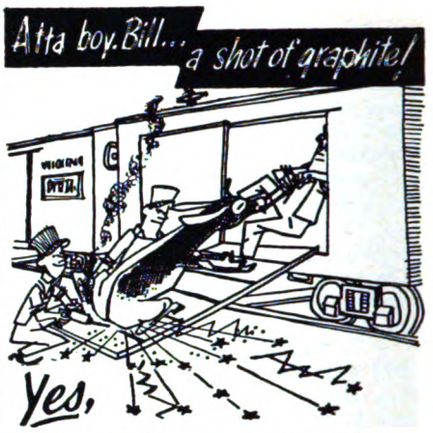
in 1924 and joined the Nickel Plate that same year as special apprentice at Conneaut. He served as assistant to chief mechanical officer at Cleveland from 1945 to October 1, 1948, when he returned to Conneaut as master mechanic.

EVERETT H. WESTON, who was recently promoted to assistant chief mechanical engineer of the Chicago & North Western at Chicago, was born in that city July 17, 1916, and received a mechanical engineering degree from Northwestern University in 1938. Starting his career in 1939 as

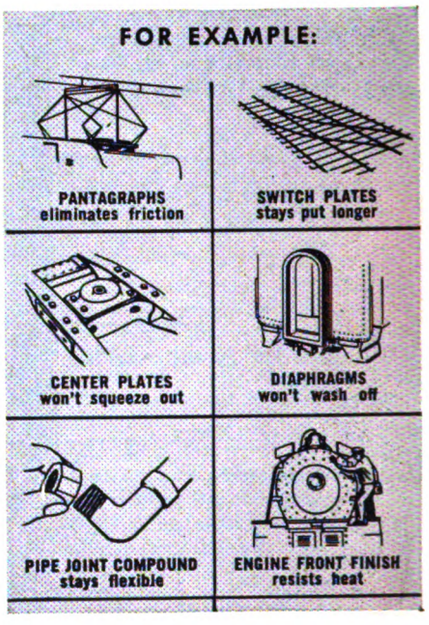


Everett H. Weston

tracer on the North Western, Mr. Weston served successively as draftsman, design engineer and lead draftsman, car and locomotive, until his promotion to mechanical engineer in 1947. It was from that post that he was recently promoted.



everything works better with Dixon Graphite!



Use Dixon *Natural* Graphite for your TOUGH lubricating jobs! And what a job it will do for you! Rain and hosings won't wash it off — withstands extremes of heat and cold — won't squeeze out under pressure. Chemically inert, too. And doesn't pick up road dust or dirt.

SEND FOR FREE SAMPLE of Dixon 1924 — Quick Drying Lubricant. Try it — it's an effective, long lasting dry lubricant, superior to oil and grease for many applications. Also, ask for your copy of technical report "Natural Graphite." Joseph Dixon Crucible Company, Jersey City 3, N. J.



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NATURAL GRAPHITE

• 1924 Quick Drying Lubricant • Center Plate Lubricant • Graphite Seal • Pipe Joint Compound • Brake Cylinder Lubricant • Engine Front Finish • Graphite for Compounding • Lathe Center Lube



GRIFFIN

Chilled car wheels are **SAFE**

AND YOU CAN GET 'EM

OFFICIAL I.C.C. DERAILMENT RECORDS SHOW CHILLED WHEELS MANUFACTURED BY ASSOCIATION MEMBER COMPANIES HAVE A SAFETY RECORD UNEQUALLED BY OTHER TYPES OF WHEELS.

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GRIFFIN WHEEL COMPANY · CHILLED CAR WHEELS

THE WORLD'S LARGEST MANUFACTURER OF CHILLED CAR WHEELS

Member ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

N. L. McCracken, master mechanic of the Southern Pacific at Los Angeles, has been appointed assistant general superintendent motive power of the Pacific Electric.

Troy H. Bickerstaff has been appointed general supervisor of air brakes on the Atchison, Topeka & Santa Fe at Topeka, Kan.

H. R. Martin, assistant master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis has been appointed special assistant to manager, equipment, of the system at New York, with duties to be assigned.

C. L. Tuttle, mechanical engineer of the Bessemer & Lake Erie at Greenville, Pa., has retired after 42 years of service with the road. Mr. Tuttle was born at Avon, N. Y., on August 1, 1881, and received his B.S. in M.E. degree from the University of Michigan in 1907. He entered railroad service during the summer of 1901 as an apprentice with the Erie and in 1907 became special apprentice for that road. He joined the B.&L.E. in 1908 as a draftsman and 10 years later became mechanical engineer.

Blair Leverett Thompson, superintendent of motive power and car equipment of the Manitoba division of the Canadian National at Winnipeg, Man., has been appointed general superintendent of motive power and car equipment of the Atlantic region at Moncton, N. B. Mr. Thompson was born on July 20, 1906, at Moncton, where he began his career with the C. N. as a telegraph messenger in November



Blair L. Thompson

1923. He subsequently served as machinist apprentice, draftsman, mechanical inspector and assistant locomotive foreman. He was appointed mechanical inspector at Montreal in 1943; night superintendent at the Point St. Charles shops at Montreal on July 1, 1945; superintendent locomotive shops in April, 1946, and superintendent of motive power and car equipment of the Manitoba district at Winnipeg in 1949.

George Charles Hoey has been appointed mechanical engineer of the Bessemer & Lake Erie at Greenville, Pa. Mr.



G. C. Hoey

Hoey was born on April 4, 1894, at Richmond, Ind., and attended Purdue University (B.S. in Railway M.E., 1916). He entered railroad service on July 1, 1916, with the Santa Fe at Argentine, Kan., as special machinist apprentice, which position he held until May 1918, when he joined the 60th Railway Engineers, United States Army. In September 1919 Mr. Hoey returned to his former position with the Santa Fe and subsequently served as machinist, motive power inspector, apprentice instructor and roundhouse foreman. From July to December 1921 he was tool designer at the Indiana Tool Company, Richmond,

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SILENCERS
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LIQUID FILTERS
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GREASE FILTERS



CAR-BODY FILTER PANEL Type P-5-RR

The ideal filter for locomotive car-body ventilation. Heavy, all-metal construction. Low resistance at high air velocities. Easy to clean.



ENGINE INTAKE PANEL ADAPTORS

Available with or without silencers for all makes of supercharged and atmospheric engines. Rugged construction. Heavy spring-loaded clamps, seal filter cells to prevent air by-pass.



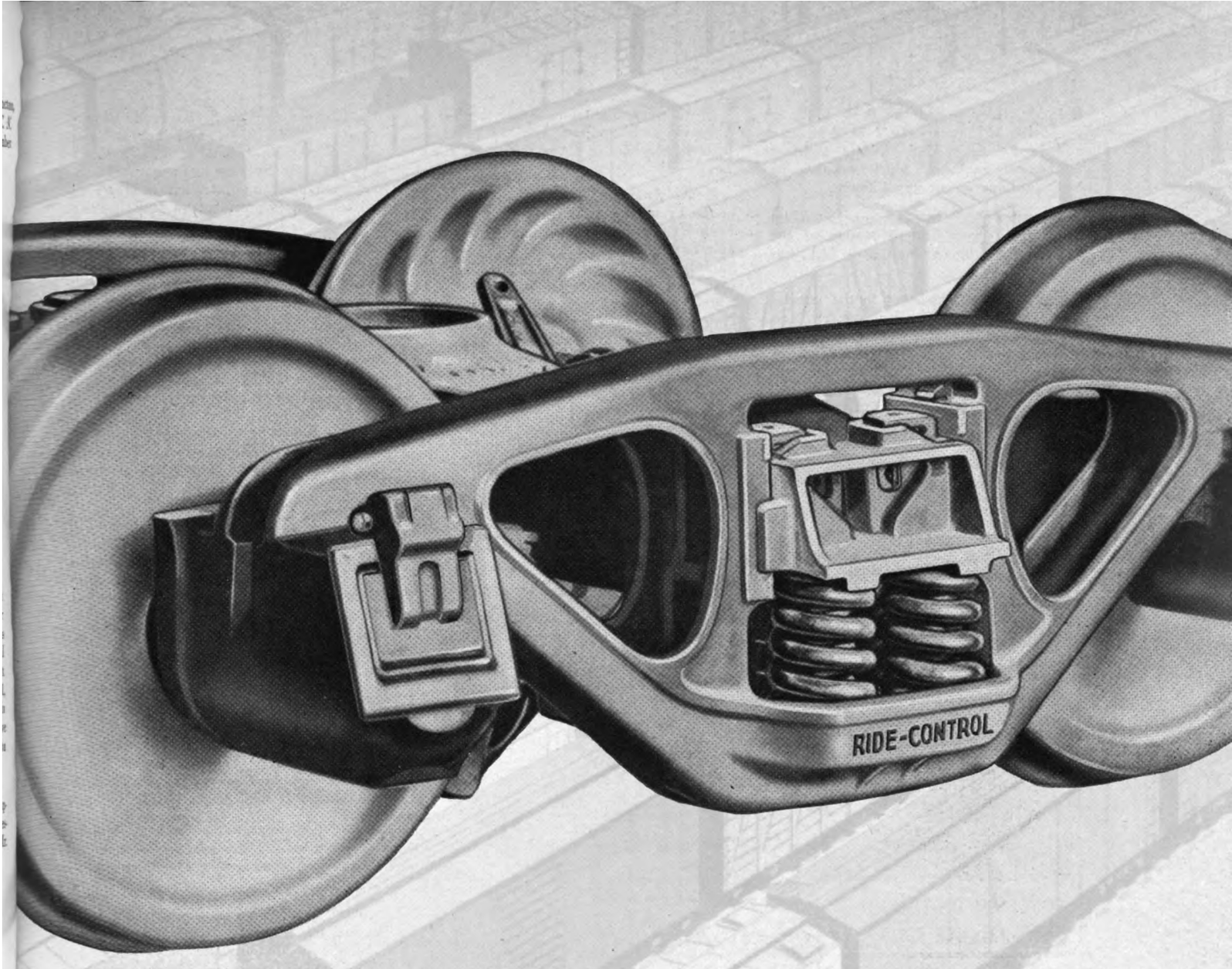
ENGINE INTAKE FILTER PANEL Type R-72-R

Specially designed for engine air intakes. Extra high efficiency at both low and high engine speeds. Will not unload.

(Offices in all principal cities)

AIR MAZE CORPORATION

Cleveland 5, Ohio, 5200 Harvard Avenue



MORE USERS BUY MORE A·S·F RIDE-CONTROL®

TRUCKS THAN ALL OTHER TRUCKS COMBINED

...BECAUSE RIDE-CONTROL IS SMOOTH-RIDING,

LONG-LASTING—CUTS OPERATING COSTS!

AMERICAN STEEL FOUNDRIES

Mint Mark of ◯ Fine Products

Ind. Mr. Hoey joined the B. & L. E. at Greenville in January 1922 as draftsman and in February 1946 became assistant mechanical engineer, which position he held until his recent appointment.

FREDERICK A. BALDINGER, superintendent of motive power, Eastern region, of the Baltimore & Ohio, at Baltimore, Md., has retired.

GUY F. WILES, assistant to the general superintendent of motive power and equipment of the Baltimore & Ohio, has been appointed superintendent of motive power, Eastern region, with headquarters at Baltimore.

H. M. EPPS, night foreman of the Texas & Pacific at Shreveport, La., has been appointed mechanical inspector at Dallas, Tex.

E. A. SWEELEY, assistant to president of the Fruit Growers Express, the Western Fruit Express and the Burlington Refrigerator Express, at Washington, D. C., retired on July 1, after more than 49 years of railroad and refrigerator car line service. Mr. Sweeley's railroad service began with the New York Central in 1902, and he subsequently served in an official capacity with a number of roads, including the Atlantic Coast Line and the Seaboard Air Line. He was a member of the Railroad Adjustment Board under the U. S. Railroad Administration (1918-1920), and became mechanical superintendent of F. G. E. in May 1920. Mr. Sweeley was appointed general mechanical superintendent in May 1947 and assistant to president on July 1, 1950.

FRANK T. MCCLURE, general supervisor of air brakes of the Atchison, Topeka & Santa Fe at Topeka, Kans., has retired after 52 years of service.

JOHN E. KLOSS, supervisor of diesel and motor equipment of the New York, Chicago & St. Louis at Cleveland, has been appointed assistant to chief mechanical officer, with headquarters at Cleveland.

P. E. ENGELBACH, equipment inspector of the Bessemer & Lake Erie at Greenville, Pa., has been appointed assistant mechanical engineer.

Diesel

S. A. JONES has been appointed to the newly created position of district inspector of diesel equipment of the Canadian Pacific at Calgary, Alta. Mr. Jones was previously diesel and gas car maintainer at Winnipeg, Man.

Master Mechanics and Road Foremen

J. H. WEBB, assistant master mechanic of the Texas & Pacific at Ft. Worth, Tex., has been appointed master mechanic, with headquarters at Big Spring, Tex.

JOSEPH W. WALSH has been appointed road foreman of engines of the New York Central, with headquarters at Kankakee, Ill.

RALPH J. HUGHES, assistant to chief mechanical officer of the New York, Chicago & St. Louis at Cleveland, has been appointed master mechanic at Conneaut, Ohio.

H. L. MCDERMOTT, general foreman of the Texas & Pacific at Mineola, Tex., has been appointed assistant master mechanic at Big Spring, Tex.

R. L. SMITH, assistant master mechanic on the Southern Pacific at Los Angeles, has been appointed master mechanic at Los Angeles.

J. H. JUDD, assistant master mechanic of the Texas & Pacific as Big Spring, Tex., has been appointed assistant master mechanic at Ft. Worth, Tex.

J. W. RONAN has been appointed assistant master mechanic on the Southern Pacific at Los Angeles.

Car

T. S. CHEADLE, chief car inspector of the Richmond, Fredericksburg & Potomac at Richmond, Va., has retired after 51 years of railroad service.

Shop and Enginehouse

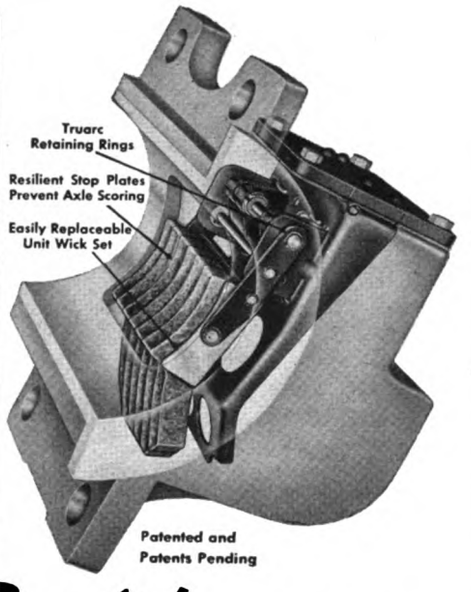
C. C. ODOM, enginehouse boiler foreman of the Texas & Pacific at Ft. Worth, Tex., has been appointed enginehouse foreman at Marshall, Tex.



CONTINUOUS SCIENTIFIC LABORATORY DEVELOPMENT



CONSTANT ON-THE-JOB PERFORMANCE TESTS...



Result! **Felpax Lubricators Reduce Support Bearing Maintenance as much as 75%**

INSTANT COMPLETE LUBRICATION with the first turn of the axle under heavy load conditions reduces babbit wipe and consequent early bearing damage. Continuous lubrication under high speeds provided by special felt wicks in constant contact with the journal insures longer bearing life.

MILLIONS OF MILES of trouble-free service on the nation's Class I Railroads have proved Felpax Lubricators provide the lubrication required to keep Today's Modern Traction Motors operating at peak efficiency.

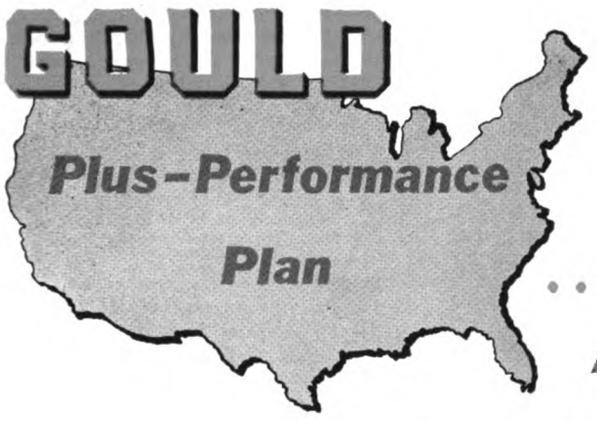
NO OTHER LUBRICATION METHOD provides all these *"Performance Proved"* FEATURES!

- **ELIMINATES waste packing and the human element involved.**
- **SERVICE reduced to periodic checking and filling oil sump.**
- **SPECIAL FELT WICKS eliminate waste grabs and starved bearings.**
- **REPLACEMENT of worn wick sets after thousands of miles of use is simplified by improved construction (see illustration above).**
- **COMPLETE KIT for replacement containing wick set, springs and necessary hardware available at nominal cost.**
- **NO MOVING PARTS subject to failure due to dirt, moisture and freezing.**

For full particulars see your locomotive builder or write to:



Miller Felpax Corporation
WINONA, MINNESOTA



...SHOWS YOU HOW ACCURATE RECORDS

LENGTHEN BATTERY SERVICE!

Keeping of accurate records is vital to the conservation and extension of essential battery power. The GOULD PLUS-PERFORMANCE PLAN makes the keeping of battery records easy by providing you with full information on how to test your batteries, and charts and forms for recording test data.

This timely plan puts at your disposal a complete system of manuals, articles, specifications, bulletins, charts, graphs and forms explaining and illustrating how to select, charge and handle, maintain and determine the condition of your batteries. This material, which can increase battery service as much as 50%, is FREE to battery users, without obligation. A request on your letterhead will bring descriptive booklet by return mail.



DAILY RECORD SYSTEM CONTROLS BATTERY MAINTENANCE

Keep a diesel battery and voltage regulator inspection card (like that illustrated below—they're FREE on request) in a holder on each locomotive unit. Identify each battery by serial number and if battery is transferred to another locomotive unit, transfer its record card also. Record pilot cell readings daily. If there is a constant drop of specific gravity, voltage regulator setting should be increased. If there is excessive temperature or water consumption, setting should be decreased. Record regulator settings, and date changes were made. Monthly inspections should be made and all pertinent data recorded. When inspection card is filled, a new one should be made out and all pertinent data including readings from last inspection, recorded on it. The old card should then be placed in a file.



GOULD "Z" PLATE BATTERIES
America's Finest Diesel Starting Batteries

GOULD BATTERY RECORD
DIESEL-ELECTRIC LOCOMOTIVES

MAKE_____ TYPE_____ SERIAL NO._____ LOCO. NO._____

DATE	SPECIFIC GRAVITY	ACID TEMPERATURE	WATER ADDED	GEN. REGULATOR VOLTAGE	
				BEFORE ADJUST.	AFTER ADJUST.

GOULD

STORAGE BATTERIES
GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY
Always Use Gould-National Automobile and Truck Batteries

C. E. MARLEY, general foreman of the Texas & Pacific at Marshall, Tex., has been appointed night foreman at Shreveport La.

E. E. LONG, master mechanic of the Texas & Pacific at Big Spring, Tex., has been appointed assistant superintendent of shops at Marshall, Tex.

L. G. WEBER, erecting shop foreman of the Texas & Pacific at Marshall, Tex., has been appointed enginehouse foreman at Ft. Worth, Tex.

P. A. WARD, machine shop foreman of the New York, Chicago & St. Louis at Brewster, Ohio, has been appointed general foreman at Brewster.

J. D. MOORE, general enginehouse foreman of the Texas & Pacific at Marshall, Tex., has been appointed general foreman at Mineola, Tex.

J. W. CAMERON, general foreman of the New York, Chicago & St. Louis at Brewster, Ohio, has been appointed shop superintendent at Brewster.

F. L. SCARBOROUGH, JR., enginehouse foreman of the Texas & Pacific at Fort Worth, Tex., has been appointed general foreman at Texarkana, Tex.

CARTER E. PARHAM, derrick foreman of the Southern at Asheville, N. C., has been appointed general foreman car repairs.

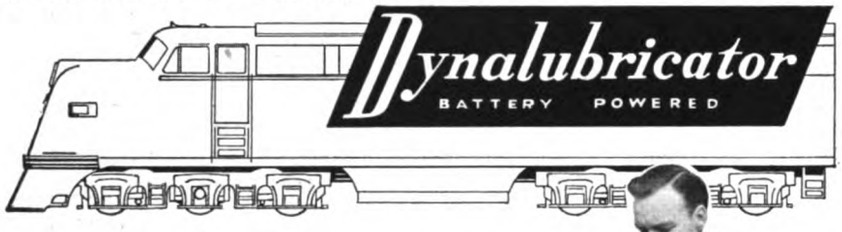
R. W. SMITH, air brake foreman of the Norfolk & Western at Portsmouth, Ohio, has been appointed assistant enginehouse foreman at Portsmouth.

Obituary

EMIL L. LARSON, former engineer of car design and maintenance of the Chicago, Burlington & Quincy at Chicago, died at Downey, Cal., on July 30. At the time of his death Mr. Larson was with the North American Aviation, Inc., with which firm he had become associated in February, 1951.

RICHARD J. WILLIAMS, who retired as chief mechanical officer of the Chesapeake & Ohio, Pere Marquette district, in 1949, died in Alden, Mich., on August 2.

REVOLUTIONARY



PUMPS HEAVIEST GEAR CASE LUBRICANTS

ELIMINATES MESSY HAND-DISPENSING

AUTOMATICALLY PUMPS MEASURED AMOUNTS



With the DYNALUBRICATOR modern shops are now servicing every gear case of a 3-unit locomotive *in just 10 minutes!* *Exact amounts* of lubricant assured by automatic metering and cut-off device. *No-Drip Nozzle* gives convenient, positive control over grease flow, eliminates messy dripping. Lubricants kept at working temperature automatically. Battery power eliminates trailing wires during operation. Easily handled by one man.

Shops now using the Dynalubricator *wouldn't be without it.* Write today for literature and full information.

SOUTHERN SPECIALTIES CO., INC.
202 CODDINGTON BLDG. CHARLOTTE, N. C.

A PRODUCT OF BROWN DYNALUBE MANUFACTURING CO.

New Devices

(Continued from page 91)

Struts are joined by integral saddles to create lateral members of great strength.

Material used for its manufacture is sheet steel or aluminum of gauges ranging from 12 to 16.

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Non-Slip Work Glove

Reinforced neoprene-coated gloves with a non-slip grip which provides a safe grip, even when handling greasy, slippery parts and materials, have been announced by the Edmont Mfg. Co., Coshocton, Ohio. For hard service in disassembling and assembling work, heavy parts handling, cleaning, degreasing, and painting, these Neox-

THE FASTEST TRAIN • THE SHORTEST ROUTE BETWEEN NEW YORK & MONTREAL



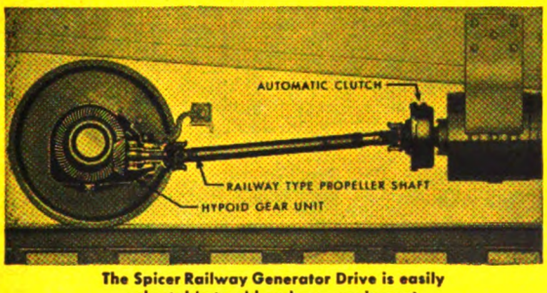
The Delaware and Hudson "Laurentian"

Spicer Generator-Drive Equipped

THE ADIRONDACKS—Lake George—Lake Champlain—Saratoga Springs area is the most readily accessible playground for millions in America. Perfect transportation facilities by "The D & H" lead to this summer paradise from all directions.

The magnificent scenic beauty of this area can be seen from the fast daily daylight "Laurentian" trip between New York and Montreal. The picturesque run is enjoyed from soft reclining-seat coaches in air-conditioned comfort. There is also a streamlined observation-lounge car on the rear of the train. The equipment is modern and all-steel throughout. Excellent meals are served in the well-appointed dining car. The extra-heavy demands for electrical service are amply supplied by Spicer Railway Generator Drives.

An imposing list of America's crack trains and streamliners rely upon Spicer equipment for electrical service of the highest efficiency. Write for literature giving complete details of the Spicer Railway Generator Drive.



The Spicer Railway Generator Drive is easily adaptable to old and new equipment

47 YEARS OF Spicer SERVICE

The Spicer Railway Generator Drive is manufactured, sold and serviced by

SPICER MANUFACTURING

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TOLEDO 1, OHIO



MAINTENANCE PROGRAM *with this New* FREE HANDBOOK

The Commutator and Slip Ring Maintenance methods and procedures described have been proven over many years in hundreds of operations. They are based upon conclusive evidence compiled by well-known authorities. Concise, practical information tells everything you need to know about scores of commutator and slip-ring problems:

- **Commutator and slip ring troubles and how to correct them**
- **Brush maintenance and operating procedure**
- **General maintenance procedure**
- **Condensed data on IDEAL commutator and slip ring maintenance products**

Dozens of illustrations and diagrams show operations described. Every operating and maintenance man should have this guide to better, more efficient, lower cost maintenance. Mail coupon for your free copy.

LOOK TO IDEAL AS MAINTENANCE HEADQUARTERS FOR:

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Please send me your free handbook on commutator and slip ring maintenance.

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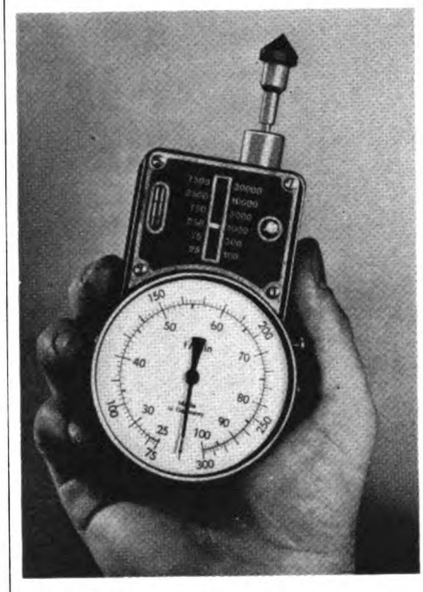
CITY_____ **ZONE**___ **STATE**_____

coated gloves are said to outwear up to 10 pairs of ordinary work gloves.

The extra tough coating is chemically welded to a strong fabric base to achieve protection against greasing and degreasing, acids, caustics, solvents, plus extreme resistance to abrasion and cutting. Seamless wearing surface eliminates splitting.

A wide, naturally-curved thumb span lessens fatigue, and provides a better grip. Its fabric lining prevents snags, absorbs sweat, insulates, makes gloves easy to take on and off.

◆



Hand Tachometer

The Dr. Horn centrifugal hand tachometer which has not been made since the Horn plant in Germany was put out of commission has again been made available by James G. Biddle Co., Philadelphia. The instrument illustrated is an improved type which has six ranges extending from 25 to 30,000 r.p.m. It is protected against damage from overspeeding, and can be operated in a vertical, horizontal or slanting position. It is supplied with a carrying case and accessories. The size of the case is 3½ in. x 2 in. x 6½ in. The weight of the instrument and case with accessories is 1¼ lb. The weight of the instrument only is ¾ lb.

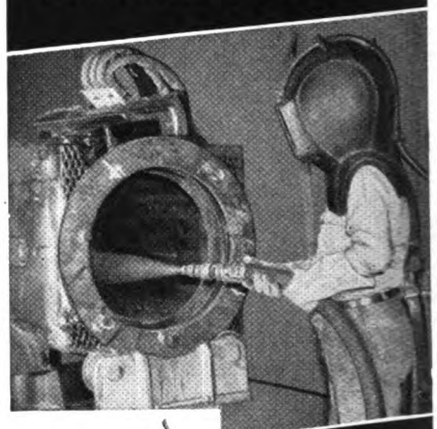
◆

Heavy Duty Electric Nut Runner

A new, heavy duty universal electric Impactool for tough nut running jobs in truck, bus, and maintenance fields has been announced by Ingersoll-Rand Co., New York 4. Known as the size 34U Impactool, it has a 1 in. square driver, and is rated for bolts up to 1¼ in. size.

The unit employs a universal electric motor and an impact unit, placed side by side to reduce overall height, which permits handling truck U-bolt nuts without jacking up the truck. The impact mechanism automatically converts the power of the electric motor to hundreds of rotary impacts whenever sufficient resistance to

CLEAN Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

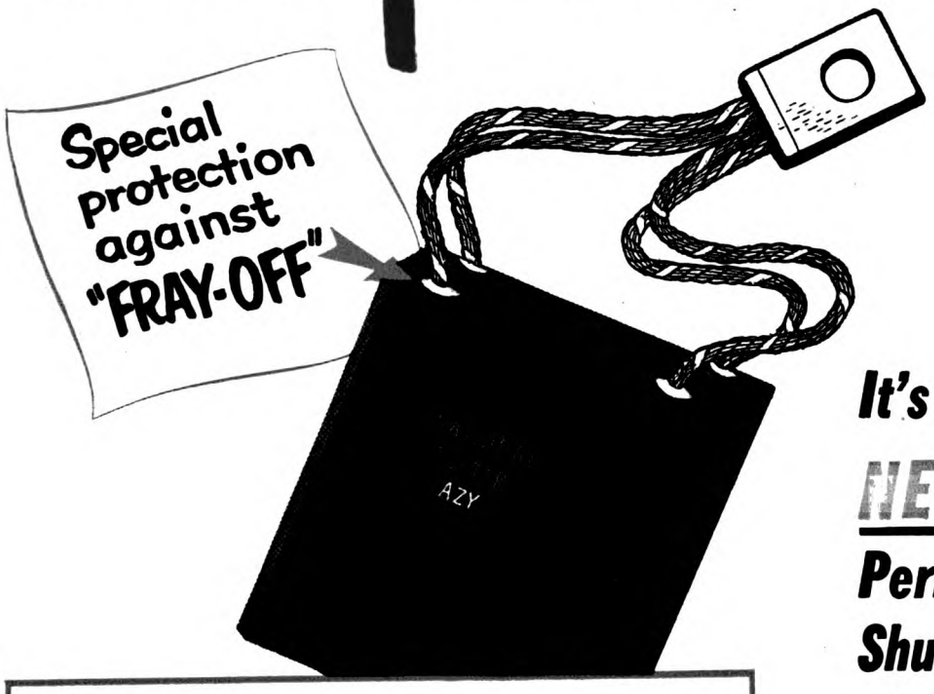
FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

Millions made to date—

NOT ONE has ever pulled out!*



We've put Permanently-Sealed shunt connections where they'll do *YOU* the most good—on "National" STANDARDIZED Brushes for diesel-electric traction motors. Available only on the standardized brushes listed below:

NC 24-7215	2 x 2¼ x ¾	(⅜-⅜)	"Plytek" Grade AZY
NC 24-7213	2 x 2¼ x ¾	(⅜-⅜)	"Plytek" Grade AX-5
NC 24-5620	2 x 1¾ x ¾	(⅜-⅜)	"Plytek" Grade AZY
NC 20-6420	2⅛ x 2 x ⅝	($\frac{5}{16}$-$\frac{5}{16}$)	"Plytek" Grade AZY
NC 20-6419	2⅛ x 2 x ⅝	($\frac{5}{16}$-$\frac{5}{16}$)	"Plytek" Grade AJH

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WRITE NATIONAL CARBON COMPANY FOR INFORMATION

It's the NEW NATIONAL TRADE-MARK *Permanently-Sealed Shunt for Diesel-electric traction motor brushes!*

* **ACCORDING TO CUSTOMERS' REPORTS AS OF JUNE 26, 1951**

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The terms "National", "Plytek" and the Silver Strand Cable device are trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
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turning is met. The tool is built to handle tough truck and bus nut running jobs such as spring U-bolt work and Budd wheel work.

One piece construction of the motor housing and hammer case provides rigidity and alignment, and at the same time reduces overall weight. Protective skid runners permit sliding the tool around while in use, without fear of damage to the gear case.

The Impactool is only 10 3/16 in. high, 4¾ in. wide, and 14⅛ in. long excluding the adjustable grip handle, which may be attached in any one of three positions, or removed entirely if desired. The other handle with the trigger switch may also be rotated 180°. It weighs 32½ lb. and comes equipped with a heavy duty plug and 3 conductor cable, packed in a metal-edge box.

◆

General Purpose Liquid Cleaner

An odorless general purpose liquid cleaner and sanitizer for industrial use, combining a quaternary ammonium compound and a compatible synthetic detergent is now being manufactured by West Disinfecting Co., Long Island City 1, N. Y.

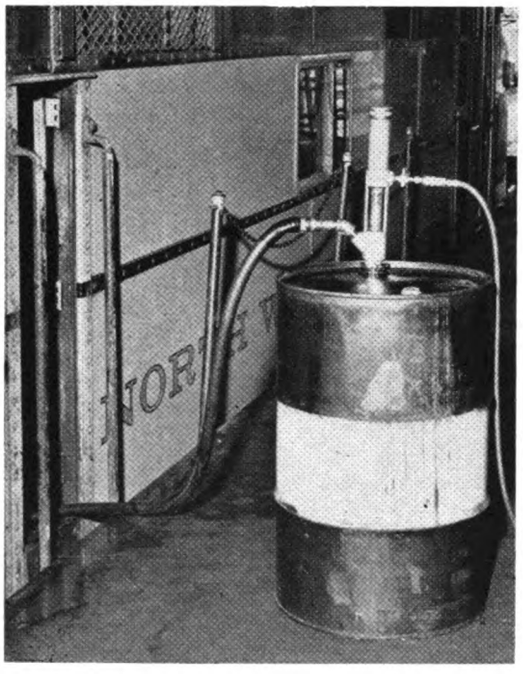
Known as Sanikleen, this solution is easy to use and permits cleaning and sanitizing in one economical operation. It eliminates the need for an extra, separate sanitizing rinse and therefore makes possible considerable savings in time, labor, and materials.

An equally effective cleanser in hard or soft water, leaving no residual soap film, the liquid can be used for cleaning and sanitizing walls, windows, eating utensils, and floor surfaces of wood, concrete, linoleum, asphalt tile, terrazzo and similar materials. When it is used according to directions, the sanitizing properties of the quaternary ammonium compound ingredient reduce the amount of bacterial contamination to a point considered safe by public health requirements.

Thoroughly tested for toxicity, the odorless solution has been found extremely safe in this respect, making it suitable where low toxicity is a prime consideration. Since the synthetic detergent is almost neutral in pH, the product is less alkaline than comparable soap solutions.

Ony one ounce of Sanikleen is required per gallon of water for general use. Surfaces can be mopped, scrubbed, or brushed with this solution; for extra heavy-duty cleaning the concentration may be increased without fear of damaging surfaces.

◆



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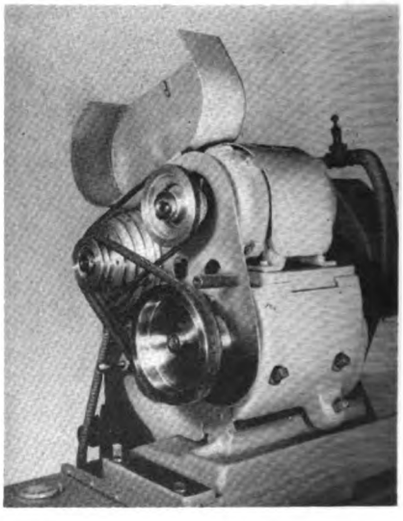
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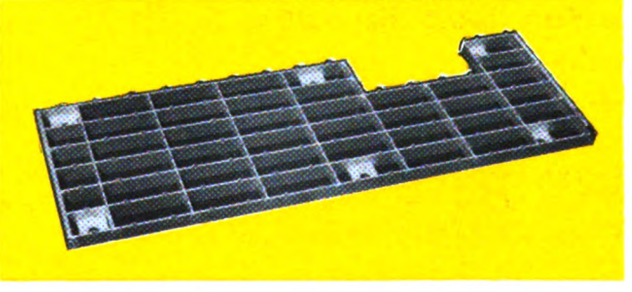
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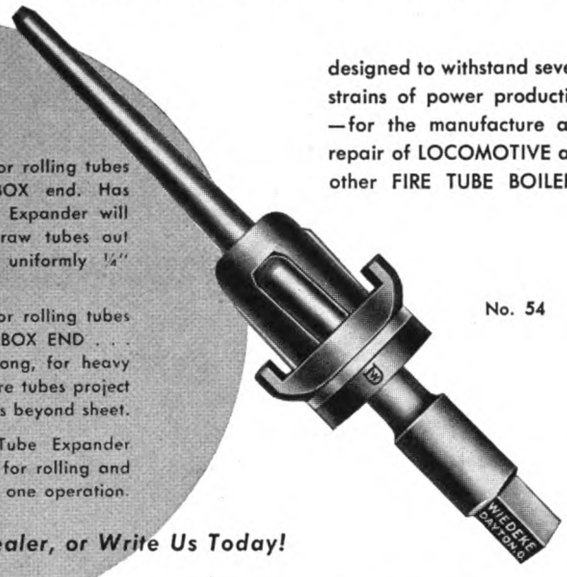
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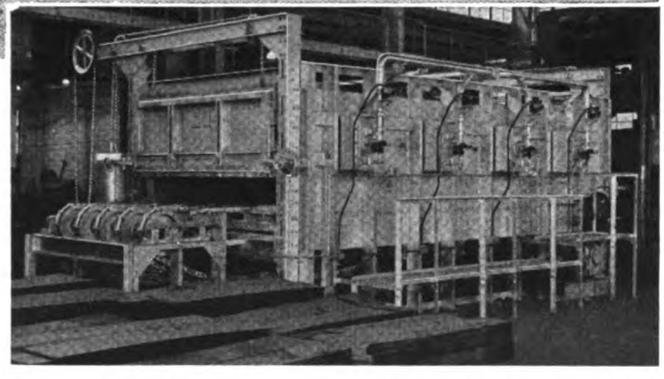
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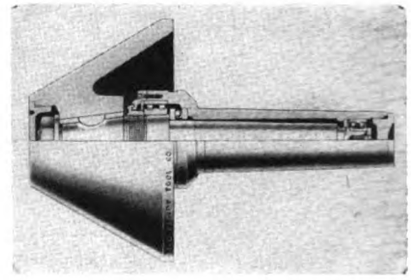
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transmitted entirely through V-belts; an eccentric arrangement for the primary countershaft provides a way to adjust belt tension and change the belt on the four step pulley. The bed is 2 in. lower than before; now only 39½ in. from the floor line to the centers. Grinding wheel collets are designed for 12 in. hole wheels, for continued usefulness on smaller machines after outside diameter wears beyond the size for efficient grinding.

Like several other features, the Filmatic bearings for the grinding wheel spindle have been retained. These bearings are self-adjusting for every grinding condition, and according to the company's record, run for years without maintenance.

◆



Multi-Purpose Center

The Ready Tool Company, Bridgeport, Conn., has developed a multi-use center. This tool is a bull nose, replaceable point center, so designed that the bull point can be removed quickly and another bull point inserted to accommodate the work—without having to remove the center on the machine.

Naturally, a center of this type is more suited for heavier type of work on tubing or pieces with large center holes and performs at top efficiency on engine lathes, turret lathes or grinding machines. The roller bearing design assures accuracy providing maximum radial and thrust load capacities. The new RED-E-Superaccurate multi-purpose centers are available in any required shank, taper or head size.

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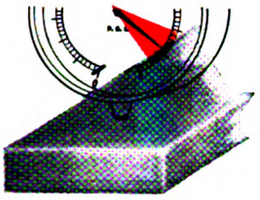
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Recommended as a replacement for cadmium or zinc in many rust-proofing applications, superior corrosion resistance is credited to Perm-Cote, a new phosphate coating material developed by Detrex Corporation, Detroit 32, Mich.

When immersed in a solution of the material, iron and steel surfaces are chemically converted into a dark gray, uniform, dense, non-metallic phosphate coating. After rinsing, the highly absorbent coating is impregnated with a rust-proofing oil known as Perm-Oil, giving the products a permanent corrosion-proof layer that is dry to the touch.

Typical applications for Perm-Cote are: springs, hand tools, appliances and sheet metal parts.

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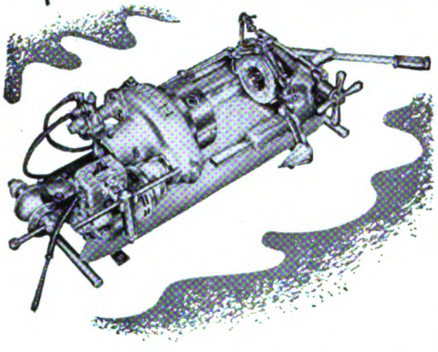
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The new low-priced, lightweight Beaver Model "E" is a "junior edition" of the heavy-duty Beaver Model A—which has, for the past 20 years, been the recognized leader in the field of portable pipe and bolt machines.

The Model "E" uses the same dieheads—the same dies—the same patented interchangeable wheel-and-roller or knife cutoff devices—the same reamer arm and cone—as the Models A and B. This will be a great advantage to thousands of shops now equipped with the Beaver Model A or B because it eliminates the necessity of carrying in stock duplicate dies and parts—thereby preventing endless confusion and needless expense. And remember, there are 195 different kinds and sizes of dies instantly available for Models A, B or E.

Although designed primarily for hardware stores and small piping contractors, BIG contractors will find the new Model "E" useful on jobs requiring extreme portability.

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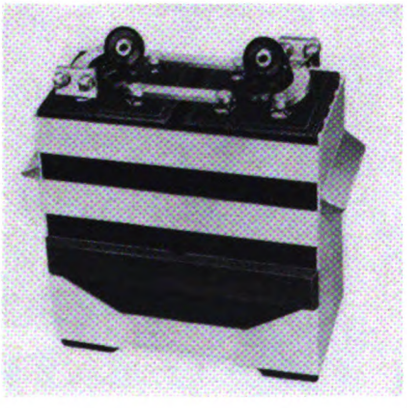
272-300 Dana Avenue • Warren, Ohio, U. S. A.



Long Life Reflector Lamp

An 800-watt reflector-type lamp, designed to burn for an average of 1,500 hrs., is now being made by the Westinghouse Electric Corporation, Bloomfield, N. J. It is 7½ in. wide, and designed for base-up burning. Light is not emitted through the reflector surface, but only through the lower surface of the lamp and the manufacturer states that this surface is of such a character that it does not readily accumulate dirt. The lamp has a standard mogul screw base and is designed for the replacement of 750-watt, 1,000-hr. lamps.

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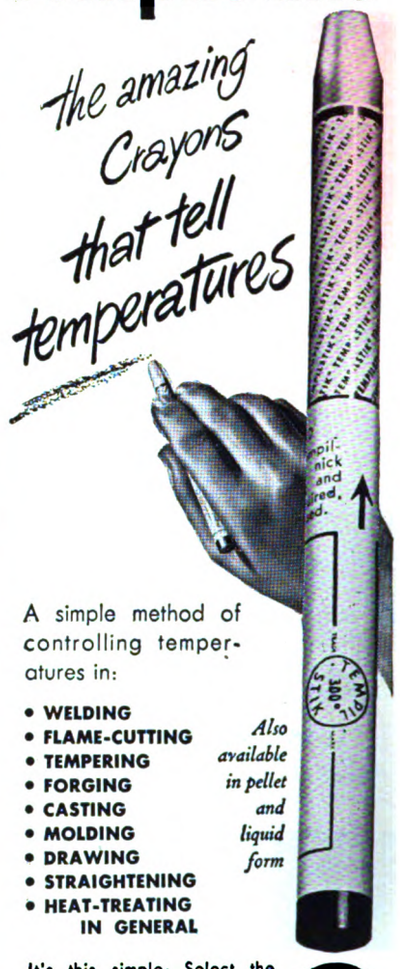


Aluminum Battery Tray

The K W Battery Company, Chicago, has introduced an aluminum tray for storage batteries. It has the same dimensions as the monobloc container, but adds the service advantage of the hard rubber jar wood tray arrangement, in that only one cell need be changed if there is a leaker. An added feature is a hinged vent cap. This is easy to open, and is closed automatically by the starting motion of the train.

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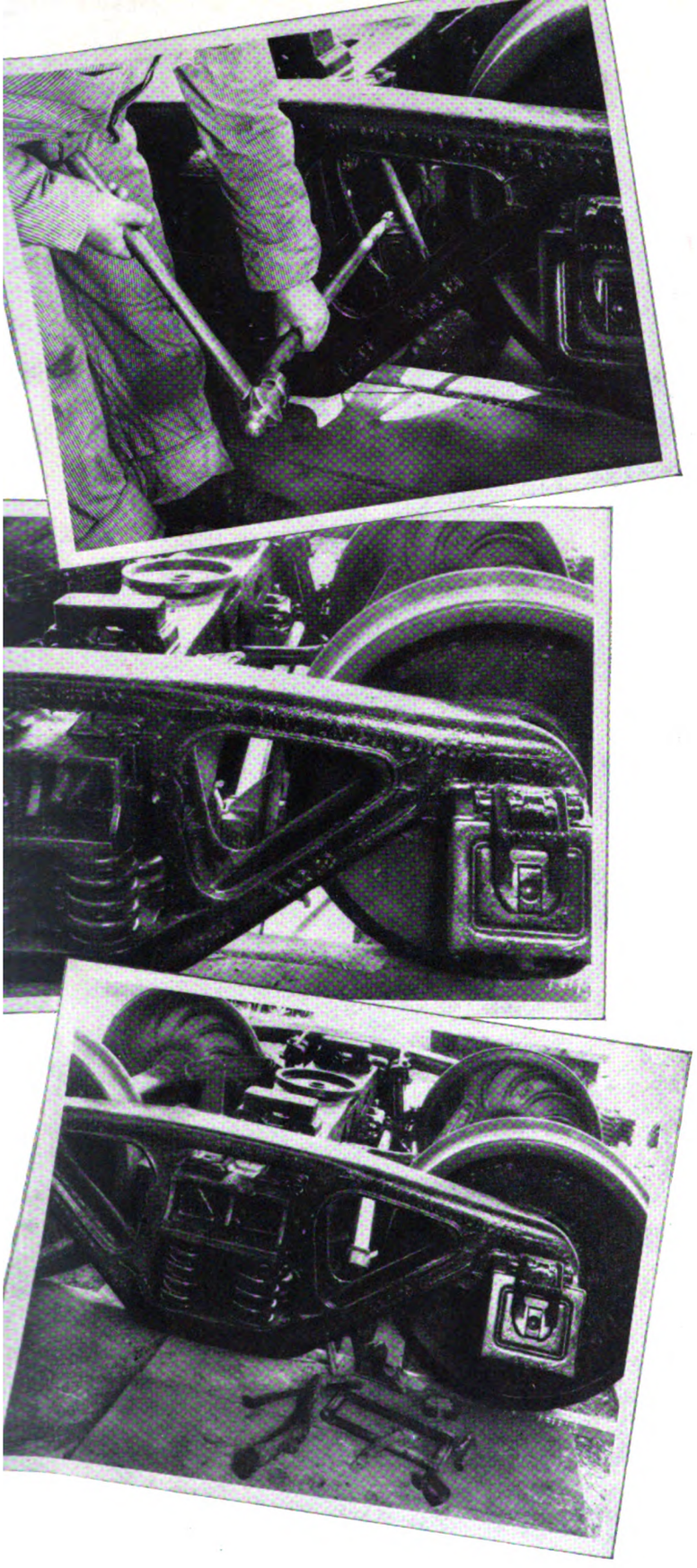
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OCTOBER, 1951

VOLUME 125

No. 10

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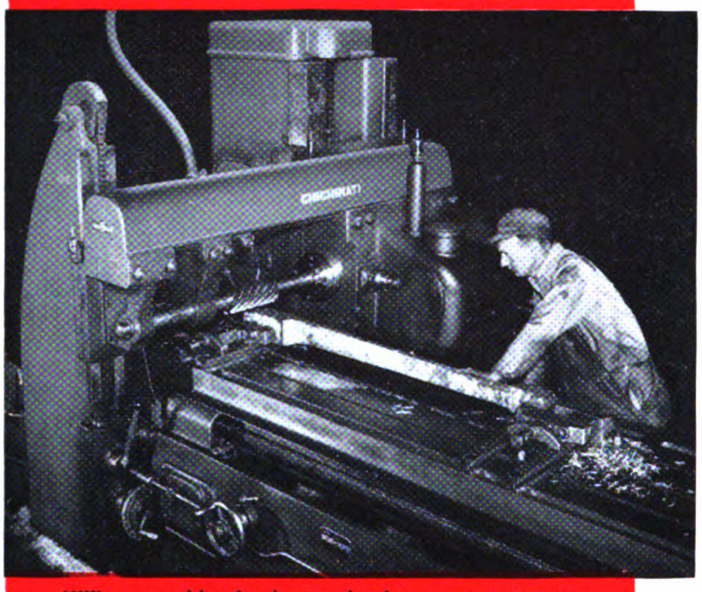
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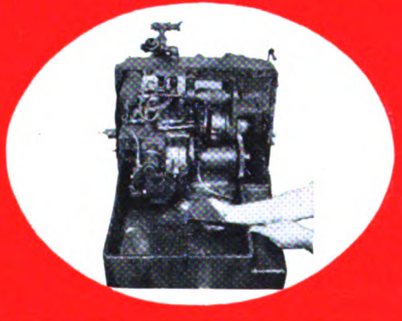
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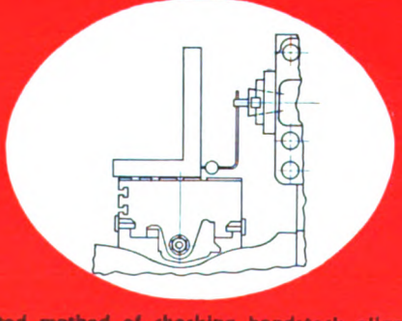
from your Cincinnati HYDRO-MATIC milling machines



Milling a combination locomotive lever, on a CINCINNATI No. 56-90 Plain Hydromatic having hydraulic manual profile control. If given periodic attention this machine will run for many years without stopping production.



Periodic oil change and attention to filter would have prevented this condition which necessitated a major overhaul.



Suggested method of checking headstock alignment.

While waiting for your new CINCINNATI Hydromatic Milling Machine, production must continue with the old machines. Here are a few precautions which you can take with new or old Hydromatics to keep them running efficiently.

HYDRAULIC SYSTEM

Oil is the very life of a hydraulic machine. Use a good quality hydraulic oil. To avoid a major overhaul job, which usually results when the hydraulic unit is neglected like the one shown in the illustration, clean the filter once a month. It's simple and easy to do. Remove filtering element and scrape out sludge once a year.

LUBRICATION

Lubrication of your CINCINNATI Hydromatic is principally automatic, but even so, it cannot be neglected. Follow the recommendations in the instruction book. As a reminder, make a lubrication chart and attach it to your machine.

LEVELING

Keep the machine level. This is especially important with long bed duplex style machines. To facilitate this operation, leveling jacks are built-in on current model machines; leveling blocks can be obtained for older models.

CLEANLINESS

Keep the machine clean. This is important for three critical areas: 1) table ways on bed, particularly older machines without way covers; 2) spindle carrier ways on headstock; 3) area around the table control plunger.

These easy-to-take ounces of prevention will pay well in years of trouble-free, accurate performance by your CINCINNATI Hydromatic.

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CINCINNATI 9, OHIO

P. S. If you're not acquainted with CINCINNATI Hydromatic Milling Machines, write for catalog No. M-1670 for Plain and Duplex Hydromatics; catalog No. M-1602 for Plain and Duplex Tracer Controlled Hydromatics.

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OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

RAILWAY Mechanical and Electrical Engineer

Chicago Coordinated Meetings Show New Trends

With an attendance of 3,818 railroad and supply men the problems of car and locomotive maintenance were discussed in many group meetings.

THE far-reaching effect of the rapid transition from steam to diesel power, the rapid improvement in passenger and freight cars and the cumulative effect of the many public relations and employee relations difficulties that the railroads now find themselves faced with are making it necessary to take stock of the situation and make some intelligent plans for the future. These were the themes of the principal speakers before the meetings of the Coordinated Mechanical Associations and the Electrical Sections, A.A.R., at the Hotel Sherman, Chicago, September 17-19, 1951. These addresses were by J. P. Kiley, president, Chicago, Milwaukee, St. Paul & Pacific before the Car Department Officers' Association; L. W. Horning, vice-president, personnel and public relations, New York Central, before the Railway Fuel & Traveling Engineers Association; F. K. Mitchell, manager, equipment, New York Central, before the Locomotive Maintenance Officers' Association, and by D. V. Gonder, assistant vice-president, Canadian National before the Master Boiler Makers' Association.

The registration for the three-day meeting totaled 3,818.

Four associations participated in joint sessions during the meetings. On Monday, the Railway Fuel and Traveling Engineers' Association was joined by the Air Brake Association for the discussion of passenger- and freight-train handling and the operation of dynamic brakes. On Wednesday the Electrical Sections joined the Locomotive Maintenance Officers' Association for consideration of a paper on the New York Central's investigation of wheel slip on diesel-electric locomotives.

In conjunction with the meetings there was an exhibit of mechanical devices at the Hotel Sherman embracing the products of 110 manufacturers under the auspices of the Allied Railway Supply Association.

Air Brake Association

The two outstanding themes at the Air Brake Association meetings were the development of information for the maintenance of 24-RL locomotive brake equipment for road diesel locomotives and the maintenance of car brake equipment in freight service, the latter subject including the effects and prevention of leakage.

According to the report there are a minimum of 51 points from which leakage can occur in a charged brake system. Of these, 27 are in the brake pipe, leaving 24 points, 17 of which are in the AB valve itself, to be included in what is known as brake system leakage. All of these may be on the reservoir side of the feed grooves, with the result that any leakage occurring at these 24 points is not taken into account by the brake-pipe leakage test. Such leakage, therefore, increases the air flow into the train only when the brakes are released and are charged.

A paper on the standardization of diesel-electric brake equipment, which was not included in the original schedule, was presented by C. E. Miller, superintendent air brakes and steam heat, New York Central, who was chairman of a committee which canvassed opinions of the best air brake minds in the country on the functions of air brake parts, additions of desirable elements and the proper application and location of parts.

The standardization paper was essentially a progress report of a committee set up by the Air Brake Association to work up information on standardizing the location and application of diesel brake equipment. The information gathered was based on experience with some 12,000 diesel units, and after approval by the association will be processed through a similar committee of the A.A.R. and made available to the A.A.R. Committee on Diesel Standardization.

The following officers were elected to serve for the coming year: president, K. E. Carey, assistant road foreman of engines, Long Island; first vice-president, R. F. Thomas, general air-brake instructor, Canadian Pacific; second vice-president, C. V. Miller, general supervisor of air brakes, New York, Chicago & St. Louis; third vice-president, D. R. Collins, superintendent of air brakes, Denver & Rio Grande Western, and secretary-treasurer, L. Wilcox. No new executive committee members were elected.

Car Department Officers

The annual meeting of the Car Department Officers' Association brought together a large group of car department men from coast to coast to discuss subjects

Exhibitors

Aeroquip Corp., Jackson, Mich.
Air Reduction Sales Co., New York
Ajax-Consolidated Co., Chicago
American Air Filter Co., Louisville, Ky.
American Brake Shoe Co., New York
American Steel Foundries, Chicago
Apex Tool & Cutter Co., Shelton, Conn.
Association of Manufacturers of Chilled Car Wheels, Chicago
B. M. & N. Filter Company
Barco Manufacturing Co., Chicago
Barton Instrument Corp., Los Angeles
Bendix Aviation Corp., Scintilla Magneto Div., Sydney, N. Y.
Blaw-Knox Co., Pittsburgh
Bowser, Inc., Fort Wayne, Ind.
Brown-Dynalube Manufacturing Co., Charlotte, N. C.
Buckeye Steel Castings Co., Columbus, Ohio
Butler Engineering Co., New Orleans, La.
Cardwell Westinghouse Co., Chicago
Carey, Philip, Manufacturing Co., Cincinnati, Ohio
Caterpillar Tractor Co., Peoria, Ill.
Chicago Malleable Castings Co., Chicago
Chicago Pneumatic Tool Co., New York
Chicago Railway Equipment Co., Chicago
Combustion Engineering-Superheater, Inc., New York
Crane Co., Chicago
Dearborn Chemical Co., Chicago
Double Seal Ring Co., Fort Worth, Tex.
Duff-Norton Manufacturing Co., Pittsburgh
Eaton Manufacturing Co., Cleveland
Elastic Stop Nut Corporation of America, Union, N.J.
Empire Journal Lubricator Co., Chicago
Enterprise Railway Equipment Co., Chicago
Evans Products Co., Plymouth, Mich.
Fairbanks, Morse & Co., Chicago
Farr Co., Los Angeles
Flannery Manufacturing Co., Bridgeville, Pa.
Fram Corp., Providence, R. I.
Franklin Railway Supply Co., New York
Garlock Packing Co., Palmyra, N. Y.
General Electric Co., Schenectady, N. Y.
General Steel Castings Corp., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Mich.
Gustin-Bacon Manufacturing Co., Kansas City, Mo.
Hennessy Lubricator Co., Chambersburg, Pa.
Holland Co., Chicago
Hulson Co., Keokuk, Iowa
Hunt-Spiller Manufacturing Corp., Boston, Mass.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll Rand Co., New York
Johns-Manville, New York
Joyce-Cridland Co., Dayton, Ohio
Leslie Co., Lyndhurst, N. J.
Lipp, J. J., Paper Co., Chicago
Locomotive Finished Material Co., Atchison, Kan.
Lunkenheimer Co., Cincinnati, Ohio
MacLean-Fogg Lock Nut Co., Chicago
Magnaflux Corp., Chicago
Miller-Felpax Corp., Winona, Minn.
Miner, W. H., Inc., Chicago
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modern Railroads Publishing Co., Chicago
Monarch Packing & Supply Co.
Monroe Auto Equipment Co., Monroe, Mich.
Nathan Manufacturing Co., New York
National Aluminate Corp., Chicago
National Brake Co., New York
National Malleable & Steel Castings Co., Cleveland, Ohio
National Welding & Grinding Co.
New York Air Brake Co., New York
Nugent, Wm., & Co., Inc., Chicago
Oakite Products, Inc., New York
Okadee Co., Chicago
Oxweld Railroad Service Co., Chicago
Parr Paint & Color Co., Cleveland
Paxton-Mitchell Co., Omaha, Neb.
Punch-Lok Co., Chicago
Pyle-National Co., Chicago
Rail Flange Lubricator Co., Portland, Ore.
Railroad Supply & Equipment, Inc., Scranton, Pa.
Railway Equipment & Publication Co., New York
Railway Purchases & Stores, Chicago
Sargent Co., Chicago
Schundler, F. E., & Co., Joliet, Ill.
Scullin Steel Co., St. Louis, Mo.
Simmons-Boardman Publishing Corp., New York
Sinkler, Joseph, Inc., Chicago
SKF Industries, Inc., Philadelphia, Pa.
Spring Packing Corp., Chicago
Standard Car Truck Co., Chicago
Superior Hand Brake Co., Chicago
Swanson, O. W., Co., Chicago
Timken Roller Bearing Co., Canton, Ohio
Turco Products, Inc., Los Angeles
T-Z Railway Equipment Co., Chicago
Union Asbestos & Rubber Co., Chicago
Unit Truck Corp.-Buffalo Brake Beam Co., New York
Universal Railway Devices Co., Chicago
Van Der Horst Corp. of America, Olean, N. Y.
Vapor Heating Corp., Chicago
Viloco Railway Equipment Co., Chicago
Watson-Stillman Co., Roselle, N. J.
Waugh Equipment Co., New York
Westinghouse Air Brake Co., Wilmerding, Pa.
Wine Railway Appliance Co., Toledo, Ohio
Wyandotte Chemicals Corp., Wyandotte, Mich.
Youngstown Steel Door Co., Camel Sales Co., Cleveland

such as freight-car interchange, billing and loading rules, air-brake maintenance, lubrication, wheel-shop practice, preparation of freight cars for higher commodity classification, air distribution in air-conditioned passenger cars and paint materials for passenger cars.

In addressing the opening session, J. P. Kiley said that, whereas railway men in many departments contribute to train operation, the rolling stock would not be on the rails at all without car men, who are now faced with the urgent need to find improved methods of doing their work. He mentioned the intense competition confronting the railroads and said that major efforts to give industry constantly improved freight service and passengers more speed, comfort and convenience must not be allowed to slacken, even if some railroad problems might otherwise be simplified. Present hot-box difficulties, he said, are partially due to stepped-up speeds in freight service, and while speed reduction would help reduce hot boxes, such a solution would be an admission of defeat. Mr. Kiley said that, but for the efforts of car men, the railroads would have even more hot boxes to deal with than they have now. These men, by better servicing of plain-bearing journals, do their share to cut down hot boxes which are causing train delays, disrupted freight schedules and higher costs.

Mr. Kiley said "It is true that car men can't do the best job for the railroads unless real coordination exists. While it is the duty of people in the operating department to get trains out of terminals and over the line, they defeat their own purposes if trains are handled in such a way as to damage cars. A coupler or its attachment damaged, a waste grab due to rough switching that can mean a hot box out on the line, a car end broken or bent due to shifted lading, all of these inevitably mean delay in yard or on the line." He also mentioned the problems in servicing and maintaining complex, modern passenger cars, including air-conditioning equipment, which the public likes and hence must be kept functioning properly.

The following officers were elected to service for 1951-52: president, W. N. Messimer, general superintendent equipment, Merchants Despatch Transportation. Vice-Presidents: A. H. Keys, superintendent car department, Baltimore & Ohio; R. Schey, general superintendent car department, New York, Chicago & St. Louis; J. F. Likarish, master car builder, Great Northern; E. E. Packard, district master car builder, Southern Pacific. Secretary-treasurer: F. H. Stremmel, assistant to secretary, A. A. R. Mechanical Division.

Electrical Sections

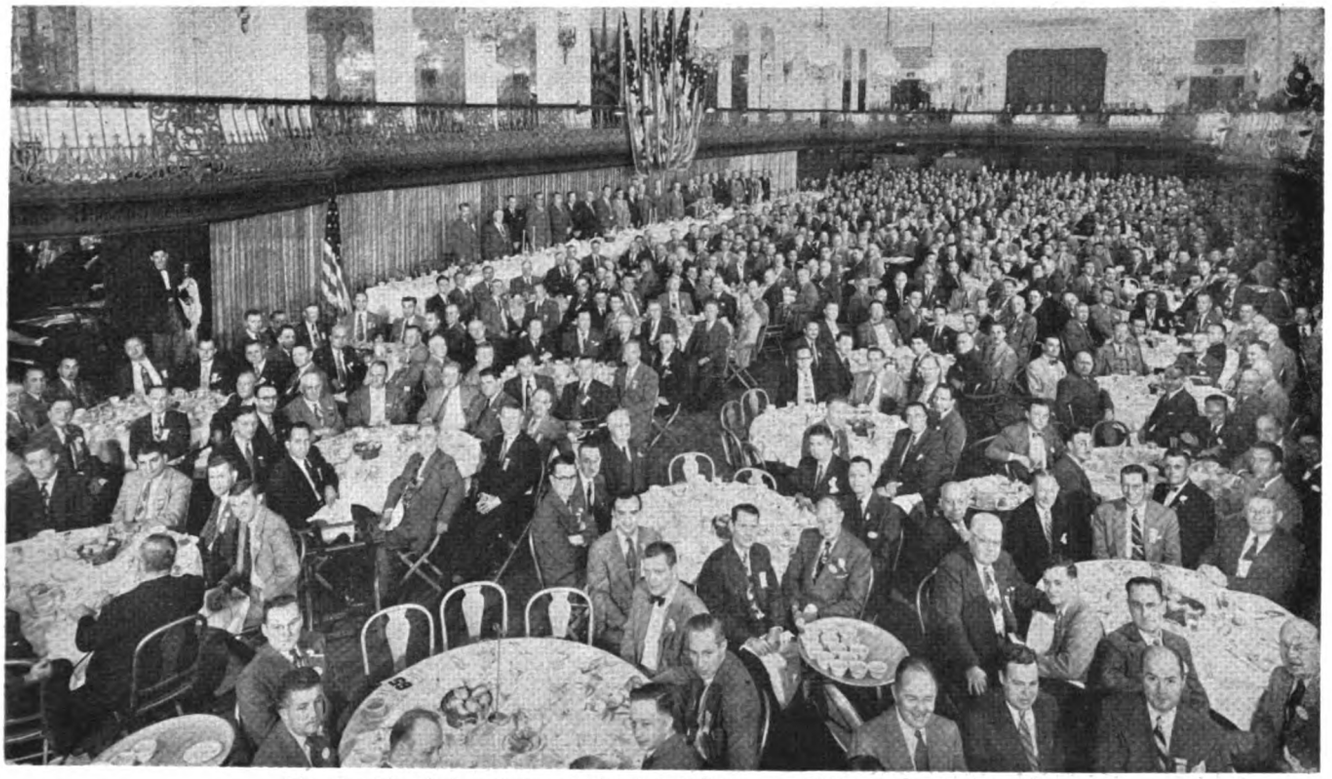
The joint sessions of the two Electrical Sections of the A.A.R. were called to order at 10:00 a.m., Monday, September 17, at the Hotel La Salle, Chicago, by H. F. Finnemore, chief electrical engineer, Canadian National, and chairman, Electrical Section, Engineering Division, A.A.R.

Having welcomed members and guests, Mr. Finnemore described the value of the reports to be presented and encouraged discussion. He said that the proposed amalgamation of the two sections had now been endorsed by both sections and would be brought before the board of directors of the A.A.R. for approval. The consolidation, if approved, will become effective January 1, 1952.

L. C. Bowes, electrical engineer, Rock Island, chairman, Electrical Section, Mechanical Division, A.A.R., laid stress on the responsibility of railroad electrical departments and said that air conditioning alone had doubled previous electrical maintenance requirements, and that diesel-electric locomotives have done much more to increase them. To this, he said, maintenance had been added by shop equipment.

Most of the electrical equipment, Mr. Bowes said, is highly specialized and requires much in the way of carefully selected and trained men. He asked section members to recognize their responsibility when called upon to be members of a committee.

Officers of the Electrical Section, Mechanical Division,



The President's Luncheon at the Hotel Sherman, Chicago, September 18

were elected to serve during the 1951-52 period as follows: chairman, H. C. Paige, assistant mechanical engineer, New York, New Haven & Hartford; first vice-chairman (west), R. I. Fort, assistant research engineer, Illinois Central; second vice-chairman (east), C. W. Nelson, electrical engineer, Chesapeake & Ohio. Members of committee of direction; P. H. Verd (west), superintendent motive power, Elgin, Joliet & Eastern; and E. J. Feasey (east), general supervisor, diesel equipment, Canadian National.

Officers of the Electrical Section, Engineering Division, are to be elected later in the year by letter ballot.

Locomotive Maintenance Officers

During the three-day meeting, in addition to the presentation of the technical reports, addresses were delivered by F. K. Mitchell, manager, equipment, New York Central System, and Edward W. Davidson, director, Bureau of Locomotive Inspection, I.C.C. Mr. Mitchell's address appears elsewhere in this issue. Mr. Davidson, in discussing safety in relation to diesel locomotives, made a special plea for a more thorough inspection of diesel wheels and brake rigging and a number of other locomotive appurtenances that are causing trouble, as well as better "housekeeping" on diesel power as a fire-prevention and accident-reduction measure. In conclusion, Mr. Davidson said in part: "We of the Bureau of Locomotive Inspection stand ready to assist in any way to effect improvement in safety on railroads. That is our job. We have certain duties in the enforcement of the law and in inspection of locomotives and an obligation to determine that they are 'in proper condition and safe to operate,' but as you know we do not like to find unsafe conditions. We much prefer to be able to give a terminal a clean bill and the personnel at that terminal a pat on the back for a job well done than to prepare a long list of defects and perhaps a few red cards."

President Paul H. Verd, superintendent motive power, Elgin, Joliet & Eastern, mentioned in the opening session that the increasing number of diesel units and the pressure of increasing costs were changing the ideas of many roads with respect to maintenance and that careful planning of facilities must now be done.

During the meeting life memberships were awarded to W. T. Faricy, president, A.A.R., and J. H. Aydelott, vice-president, operations and maintenance department, A.A.R.

Mr. Faricy, in discussing the rate situation in his remarks following the presentation said, in part, "Everybody knows by this time that the rate increase the Interstate Commerce Commission granted the railroads recently was wholly inadequate. . . . The increase asked was 15 per cent; they granted 9 per cent in the East, 6 per cent in the West. 6 per cent in the South."

The figures on which railroads rested their case, the A.A.R. officers said, show that since 1939, the year the recent war started in Europe, railroad wage rates have gone up 140 per cent and the cost of materials purchased by railroads has increased approximately 131 per cent, while railroad revenues—in terms of revenue per ton-mile—are estimated to be no more than 45 per cent higher, including the latest (Ex Parte 175) increase. This disparity between income and outlay is too big a gap to be completely bridged. he emphasized.

"A lot of it can be bridged, has been bridged by increasing efficiency," Mr. Faricy continued. "but it is the national policy, as written into the Defense Production Act, through the so-called Capehart amendment, that

businesses generally are allowed to increase their prices by increases that have taken place in wages and materials. We in the railroad industry feel that although we are not subject to Office of Price Stabilization regulations, but, instead, are under the I.C.C., that this same principle should be applied to railroads. It is difficult for us to see why we, alone, should be singled out and told that we may not raise our prices by the amounts that our costs have gone up."

With the exception of one report on steam locomotive terminal operation and a report on personnel training, all of the other eight reports dealt with some phase of diesel mechanical and electrical maintenance.

Of incidental interest is the fact that the paid membership of the L.M.O.A. is now over 3,200, making it one of the largest associations in the railroad industry.

The following officers were elected for the ensuing year: president, H. H. Magill, superintendent motive power, Chicago & North Western; first vice-president, S. M. Houston, assistant general superintendent motive power, Southern Pacific; second vice-president, F. D. Sineath, assistant general superintendent motive power, Atlantic Coast Line; third vice-president, T. T. Blickle, mechanical superintendent, Coast Lines, Atchison, Topeka & Santa Fe; fourth vice-president, J. T. Daley, superintendent motive power, Alton & Southern. E. K. Bloss, mechanical superintendent, Boston & Maine, was elected to the Advisory Board, and W. E. Lehr, superintendent motive power, Lehigh Valley; F. W. Bunce, superintendent motive power, Chicago, Milwaukee, St. Paul & Pacific, and A. L. Wright, superintendent equipment, New York Central, were elected to the executive committee for one-year terms. C. M. Lipscomb, assistant to schedule supervisor, Missouri Pacific, continues as secretary-treasurer.

Master Boiler Makers

With his "Eye to the Future" address, D. V. Gonder, assistant vice-president—operations, Canadian National, set the theme of the thirty-fourth annual meeting of the Master Boiler Makers' Association. Facing the fact that the boilermakers' craft is adversely affected by the rapid dieselization of the railroads, Mr. Gonder presented several suggestions for new opportunities. He told the members they should improve themselves by studying labor relations, by knowing accounting procedures and how to allocate material and labor costs, and by looking around for work in which the experience and craftsmanship of the boiler maker can be utilized by the railroads. Some of the new fields suggested were parts of diesel locomotive maintenance, the fabrication of structural members, stationary boilers, and steel car work.

The association started its "looking-to-the-future" program by changing its constitution to make railroad welding and water service supervisors eligible for active membership and to hold office, these two classifications having been restricted to active boiler makers in the past. It proposes to strengthen its future programs in these two fields that are closely allied to the work of the boilermaking craft .

President R. W. Barrett, chief boiler inspector, Canadian National, presided at the meeting.

New officers elected for the following year are: president, H. C. Haviland, supervisor of boilers, New York Central; vice-president and chairman of the executive board, H. R. Barclay, general boiler inspector, Northern Pacific; secretary of executive board, F. R. Milligan, general boiler inspector, Canadian Pacific. A. F. Stiglmeier was re-elected secretary-treasurer. Also re-elected as members of the executive board are R. A. Culbertson, general master boiler maker, Chesapeake & Ohio; Benjamin G. Kantner, general boiler and welding supervisor, Reading, and F. E. Godwin, system chief boiler inspector, Canadian National. A. A. Edlund, assistant general boiler inspector, Chicago, Milwaukee, St. Paul & Pacific, was elected as a new member of the executive board.

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REGISTRATION—COORDINATED 1951 MECHANICAL MEETINGS

Associations	Railroad Men
Air Brake	280
Master Boiler Makers'	215
Car Department Officers'	563
Locomotive Maintenance Officers'	1,017
Railway Fuel & Traveling Engineers'	268
Electrical Sections, A.A.R.	155
	2,498
	Supply Men
Allied Railway Supply, Mechanical	1,152
Allied Railway Supply, Electrical	168
	1,320
Total	3,818

Railway Fuel and Traveling Engineers

For Mr. Horning's address the members of the Railway Fuel and Traveling Engineers' Association were joined by many from other groups. Too often, he said, industry has not applied to its human relations the same degree of effort and skill that it has used in dealing with mechanical aspects. As a result, understanding between management and employees, and between management and the public, has suffered, with all three parties being the losers.

He felt that one of the most pressing concerns facing the railroad industry today is the winning of better public relations through its employees. Those in or near the front line of supervision are in a strategic position for reaching the broad ranks of employees, who, in turn, can exert great power on behalf of good public relations.

Railroads need favorable relations with the public because they face aggressive competition and because they are subject to control by agencies of the public. These can be fostered by employees other than those in direct contact with the public—engine crews, for example, by the way they handle both freight and passenger trains and by the way they observe smoke control regulations. All employees—as members of their community—can help shape the opinions of their friends toward their company. They can do this when they come to look upon themselves as auxiliary public relations men and to accept public relations as part of their job.

The best way to get a man to do something is, first, to get him to want to do it, and there are two ways of accomplishing this in so far as public relations consciousness is concerned. First, share the knowledge of what the railways face in general and what his particular employer is up against. Second, do not ignore the essen-

(*Continued on page* 65)

We Pause To Plan*



By F. K. Mitchell †

NEVER was it more essential that careful planning precede final action than it is now while most railroads are in the process of substituting diesel-electric motive power for steam. This is true regardless of the size or character of the railroad involved. Unless it is done, any railroad may find ultimately that they are without adequate facilities; have adequate facilities at the wrong location; either have too many or too few power units, or have the wrong type of power for the job it is called upon to do. Unfortunately, some smaller roads that are close to the end of their dieselization program have already found themselves in a quandary which the lack of planning has produced.

Throughout the length and breadth of the United States there may be found now the ghost of shops and terminals once considered indispensable and later found to be unnecessary. The gradual change in the character of railroad motive power has been largely responsible for this situation. In most cases the changes which brought on the situation could not be anticipated because of their gradual development. In some few cases failure to note the trend of the possibility of change requirements being imminent has likewise been responsible for these errors. Regardless of the reason, it has been expensive and fraught with insidious results, some of which have never been fully recognized. One of these insidious things has been the necessity to disrupt entire communities when the shop or facility is closed. This, of course, cannot be entirely eliminated, but it can and should be minimized. The less there is of it, the greater the economy which will accrue to the railroad company and the less the destruction there will be to the morale of the employees.

We are now faced with the greatest change in the character of motive power that has ever been experienced in the history of the railroad business. Over night, a new transportation tool has been placed in our hands which offers possibilities never heretofore available. The change we are going through in a short period exceeds all the changes which have accrued since the first steam locomotive was put into service. Therefore, the chances of error in our preparation to get the most out of this tool are far greater than any which have been experienced in the past. It, therefore, behooves us to have a definitely clear picture of what we will need in the way of motive power, heavy repair shops, terminal facilities, fueling and sanding stations before we proceed too far.

How will your railroad be operated when we are fully dieselized? This is a problem which cannot be solved without clear thinking. It is primarily, of course, the matter for the transportation and operating officers of a railroad to determine. Generally speaking, we have now had enough experience to know what the new form of motive power can be expected to do. We have a good idea of its capacity to handle tonnage, to produce gross ton-miles, its availability, its fuel and its sand requirements, and finally the type and extent of maintenance which will be necessary. Based on these known facts, the problem is how can we use the diesel-electric locomotive to the greatest advantage and what effect will this have on our operation? We now have a locomotive which, quite in contrast with the steam locomotive, is not limited in its ability to handle trains of any type or size or to operation on one or two divisions, but only to the unit combinations and the territorial areas in which it is found economical to use it.

It is quite obvious, therefore, that, if we assume that we are going to need shops, maintaining and servicing facilities of this type of power in the same locations that were found necessary when steam power was involved, we are likely to over build or to have our facilities in the wrong locations. These days the cost of such errors is enormous. Let us assume that we build only one too many maintenance facilities or build it in the wrong place where it must be abandoned. If this facility is one capable of doing all the necessary work on a large group of diesel locomotives between general repairs, we have probably thrown away in the neighborhood of two and one-half million dollars. If we build only one too many running repair facilities, depending upon its character, we may have thrown away in the order of a quarter of a million dollars. Even if we install only one fueling and sanding facility that is not going to be needed or is found to be improperly located, we may spend a hundred thousand dollars more than is necessary. All of these useless expenditures, to say nothing of the effect on the morale of employees, if we find it necessary to abandon a facility, emphasize that the plan must be as near perfect as it can be made. We must, in planning the operation of our railroad, fix the most economical points at which to place each type of facility. This, therefore, is the first and probably the most important step in the planning.

How Many and What Kind?

What will the number and type of diesel locomotive units required ultimately be? After the operation plan

* An address before the Locomotive Maintenance Officers' Association at the Annual meeting, Chicago, September 17, 1951.

† Manager, Equipment, New York Central System.

is completed, based on our knowledge of the capabilities of the diesel locomotive, this step is more or less routine, but for that reason it is nonetheless important and involves some features that must not be overlooked. Primary among these are the types of power most adequate to handle the various kinds of services. The roads which were unfortunate enough to complete, or nearly complete, their dieselization before the road switchers came into being have already found themselves at a loss to know where to turn for an adequate motive-power unit to handle their local service. Such pertinent questions as whether or not the dynamic brake, steam generators, multiple unit control, train control and other features locally required for the most economic operation must be considered as well as the size and capacity of the various types of diesel locomotive units to be acquired. Any errors in decisions reached on these questions could, of course, be corrected later, but in so doing the cost will no doubt pyramid and during the changeover the availability would be materially affected.

Further, it must be determined, particularly on roads where business levels vary widely, how the peaks can be taken care of with the least expense. No road, large or small, can afford to have diesel-electric locomotives standing by with nothing to do, waiting for peak business in either freight or passenger service to develop. Certainly the plan should incorporate as many multiple purpose locomotives as are necessary to cover the peaks. This is a matter for considered study. Any mistake in one direction may result in a road not having adequate power when it is needed, and a mistake in the other direction may mean an expenditure of some one hundred thousand dollars per unit for each unit eventually found not to be absolutely necessary. Fortunately, on most roads the peak of passenger and freight business does not occur at the same time. Therefore, the dual-purpose or the all-purpose locomotive seems to fill the bill satisfactorily.

It is true that, following this procedure, there may be occasions when the available locomotive unit may not be exactly the one which would be selected otherwise. Perhaps in off periods it may be necessary to work a locomotive of greater horsepower than the job would require, or, on the other hand, during peak periods it may be necessary, for instance, in passenger service to use a locomotive not capable of the top speed which normal operation would require. Nonetheless, it is certain that these temporary restrictions will not be prohibitive and will furnish an acceptable medium for getting over the peak. Because of all of these pertinent matters, any road's study as to the ultimate power requirements must, of necessity, be done on a system-wide basis in order to get the greatest use and the most satisfactory performance from a minimum motive-power complement.

What will the ultimate heavy repair shop requirements be? There was a time when divisional back shops were a necessity. The development of the steam locomotive and the gradual increase in its availability and its ability to operate satisfactorily over more than one division started a trend toward fewer back shops which has continued through the years. We are now faced with the problem of how extensive the reduction in the number of back shops will be when the dieselization is completed. Fortunately, it is generally conceded that little change is required to make a steam locomotive back shop of the transverse pit type adequate for general repairs to diesel-electric units. Therefore, it is quite probable that there are more potential diesel-electric back shops available than will be necessary and, if one is not found adequate, a second can easily be converted.

It is suggested that the better procedure would be to select the steam locomotive back shop which is the best located geographically for the load and attempt to do all the required diesel-electric back shop work at one point. The work load on such a shop can be estimated at this time, but it is doubtful whether it can be definitely established for the future. It is sensible to figure that back-shop requirements will grow as the age of the diesel-electric motive-power fleet increases; only time will tell exactly how much that increase will be. Therefore, if the first effort is confined to one shop believed to be adequate, it is well to have another available to take the overflow in the future if it is found that the first shop cannot handle the ultimate load. On the other hand, part of this problem is tied up with the question of what the policy is to be regarding the overhaul of diesel locomotive auxiliaries, such as engines, generators, traction motors, blowers, etc. This policy, once established, will help in the final determination. Any steam locomotive back shop known definitely not to be required for diesel locomotive operation should, of course, be dismantled for economic reasons. If there is any question about whether or not it is to be needed for the new type of power, there should be no question of preserving it until experience permits the answer to the question.

How About Terminals?

What will the ultimate terminal requirements be? Here the problem is tied up very closely to the solution of the operating question, not only with regard to the size and character of the equipment therein, but likewise with regard to capacity for various types of work. Of this type of facility there will probably be more than one basic design. There will be one type, no doubt, capable of completely maintaining diesel-electric units between general repairs. In designing such a facility, it should first be determined from the operation how many units of each type (road, road switch or switch) will have to be serviced therein. To the extent that operation permits, diesel-electric power may be worked to such a shop for the necessary attention. No attempt should be made to concentrate sufficient work of this type at one point to require any considerable amount of doubleheading or light movements thereto or from. Therefore, it is important that a facility of this character be located at a point where the available runs in and out are the greatest. The very minimum construction of such facility which may be provided with economy is essential. One of the compelling reasons for this decision is that there must be enough work load at any such facility to permit men trained for specific jobs to have work available for them at all times. Such a situation will be found to be economic and desirable. This type of facility, it will usually be found, cannot be satisfactorily or economically built into an existing steam locomotive terminal, particularly if the latter be the standard steam locomotive roundhouse.

There will be a second type of facility which will be required capable of handling ordinary emergency running repair work which cannot be diverted to the type of shop first mentioned. This facility will, in all probability, need to be equipped for dropping wheels and traction motors, overhead crane equipment adequate for head and liner work, and possibly for the renewal of such items as engines or generators. Ordinarily, it is believed that the load in such a shop will more generally be confined to diesel yard power and, perhaps, road switchers. Such a facility can, if there is one available, be converted from an existing engine terminal. Here again, the number of

facilities of this kind which are established should be *held to* a minimum and their location dependent upon the operational requirements, and its construction dependent upon whether there are adequate existing buildings available.

Don't Overlook Inspection Facilities

There will, no doubt, also be a third type of facility. Such a facility should provide an inspection pit and probably need not include either drop pit or overhead crane facilities. As a matter of fact, if climatic conditions are favorable, at this type of facility a building is not a must. It may be required because of the isolation of the point and the fact that the power handled has no opportunity to get into a more adequate shop except at intervals, or, on the other hand, it may be required as an inspection station in which it can normally be determined whether the necessary work can be done on the spot or whether the unit must be sent to a more adequately equipped facility. Such a facility as is now being discussed should, of necessity be either in the yards or closely adjacent thereto in order to minimize the turnaround time of all power not requiring extensive inspection or repair work.

What will the future requirements for fueling and sanding facilities be? Quite obviously there must be fueling and sanding facilities in connection with the first two types of facilities mentioned above. In connection with the last type of facility discussed, however, it may not be advisable to have either permanent fueling or sanding facilities. In some instances it may be found that the fueling can be satisfactorily handled by tank wagon service or from a fuel car. This same car can be built to also dispense dried sand, dried elsewhere and supplied to the point by "X" equipment.

At points where permanent fueling and sanding facilities are a requisite, the number of tracks served, the capacity of fuel and sand supplied must be determined from the character of the operation and the number of units forecast to be dispatched daily. The fuel supply at such a facility should probably fe adequate for at least ten days' operation. The sand supply should likewise be adequate for at least ten days' operation. Whether sand is to be dried locally or at some central point should be determined, for the duplicating of sanding facilities where unnecessary is expensive and it may be found more economical to dry the sand at a central point, perhaps where the first type of shop is located and distribute therefrom to the other types of facilities in company cars designed for this purpose. Even though dried elsewhere, sand should be dispensed to diesel-electric units from sand towers located in the vicinity of the fueling station so that both fueling and sanding can be accomplished without the necessity of moving the locomotive. The number of outlets will be affected by the maximum size of locomotive which it is forecast to be handled at the point.

It should not be overlooked that another type of minor facility might be necessary at isolated points where diesel units are laid up overnight. Ordinarily, at such points fueling and sanding of diesel units will not be necessary. Where climatic conditions make it advisable, these points should likewise be equipped with standby service for heating diesel units so that freeze-ups will be avoided and relatively easy starting made possible before dispatchment.

What should your fuel storage facilities ultimately incorporate? This problem, of course is dependent upon the operation, the number and type of units, source of supply and other pertinent factors. For years it has been the practice to stockpile coal for steam locomotive consumption in cases of emergency or fuel shortage. There is no less reason to believe that the stockpiling of diesel fuel would be an economic and desirable practice. Diesel fuel oil storage tanks and pumping equipment adequate for unloading and loading tank cars must, of necessity, be incorporated in the overall plan. It is essential that these operations be made nearly as automatic as possible for economic reasons and their capacity should provide at least a 60-day backlog of fuel for the railroad. Their location will be dependent to a large extent on the center of gravity of diesel usage and on the sources of supply. Such problems cannot be solved by the mechanical department alone, but must be solved by joint cooperation of the transportation, stores, purchasing and mechanical departments.

If all phases of the planning for future railroad dieselization are carefully carried out at this time, the errors will be minimized and the system will work out economically and satisfactroily, but, on the other hand, if you neglect the planning and allow the system to grow up like Topsy, your headaches in the future will be many and severe. Certainly you can't do today's job with yesterday's tools and expect to have your costs in line tomorrow.

Chicago Coordinated Meetings Show New Trends

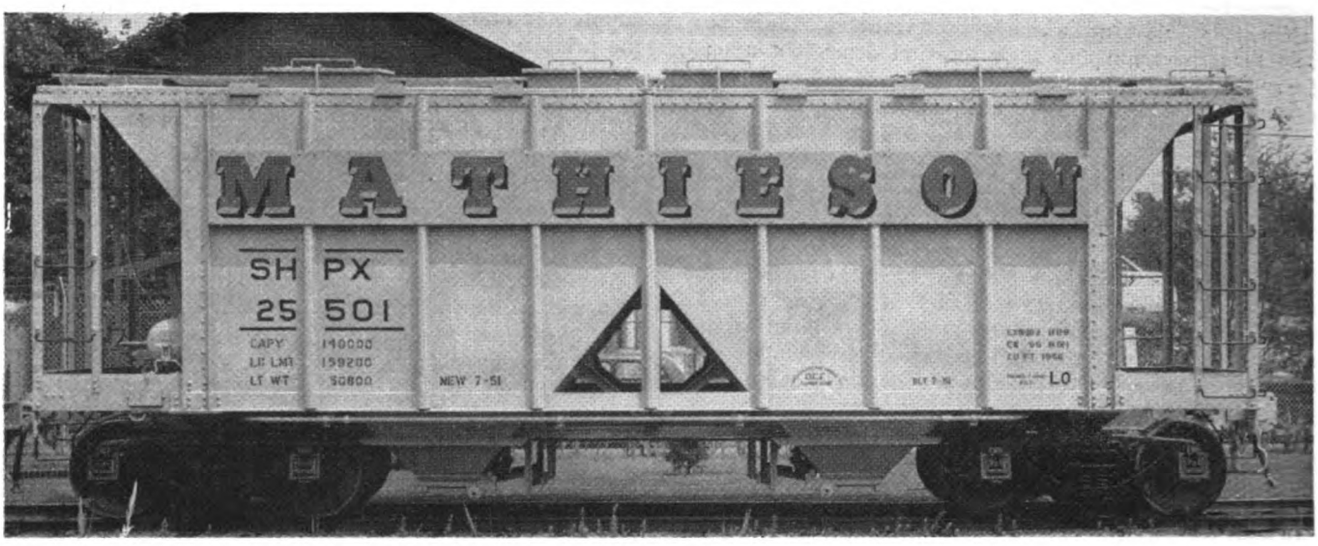
(*Continued from page* 62)

tial community of interest between labor and management.

Getting the railroad to take an active part in public relations is not making him over into something that he wasn't before. Rather, it serves as a means to guide and assist him in realizing a further potential in the interest of himself and his company. The value of this is realized by the men's own labor union who last year joined with representatives of management in a joint draft which affirmed the industry's need for public good will and the advantage to the employee in helping his company to attain it.

The program of this association, like those of the others, dealt largely with various aspects of diesel locomotive operation and the training of locomotive operating personnel. Problems relating to the efficient use of coal and oil in steam locomotives were dealt with, however, in two papers.

The following officers were elected to serve during the next year: president, R. H. Francis, general road foreman equipment, St. Louis-San Francisco; vice-presidents: R. D. Nicholson, road foreman engines, New York, New Haven & Hartford, W. H. Fortney, chief road foreman engines, New York Central, and E. L. Reeves, trainmaster, Baltimore & Ohio. The following were elected members of the executive committee: T. H. Bickerstaff, general supervisor air brakes, Atchison, Topeka & Santa Fe; T. L. Henley, chief fuel supervisor, Missouri-Kansas-Texas; F. G. LaNaster, assistant fuel supervisor, Chicago, Burlington & Quincy; R. R. Rich, road foreman of equipment, Chicago, Rock Island & Pacific; J. S. Swan, supervisor locomotive operation, Louisville & Nashville; and C. R. Patterson, fuel supervisor, Canadian National.



Covered Hoppers Built by A.C.F.

Two-compartment cars have capacity of 70 tons and weigh 50,700 lb., light

THE American Car & Foundry Co. has recently completed 25 all-steel covered hopper cars for its subsidiary, the Shippers' Car Line Corporation, which have been leased to the Mathieson Chemical Corporation. These cars, built at the Berwick, Pa., plant, have a nominal capacity of 70 tons, weigh 50,700 lb. light, and are 35 ft. 3 in. long over striking castings. They are built from designs from which a total of 70 cars have so far been built this year for the Shippers' Car Line. The cars are divided into two compartments, each of which has two discharge openings. They are built with outside frame members and all body plates are joined by welding. The roof is riveted and is joined to the body by riveting.

The underframes are built up on A.A.R. Z-26 sections, the edges of the top flanges of which are joined by continuous welding along the center line of the car. The total cross-sectional area is 24 sq. in. The body bolsters are of riveted construction. The web plate is in one piece cut out to fit over the center sill. It extends across the car and is completed with top and bottom chord angles and 18-in. top and bottom cover plates. The bolster is attached to the top of the center sill by angles and to the center-sill webs by pressed diaphragms. Angles are employed for attachment of the ends of the bolsters to the sides of the car. The end slope sheet is supported over the bolster by a 12-in. bent plate supported at the sides by tapered gussets extending up from the top of the bolsters at the sides and riveted to the bent plate at the top. At the center are four angles extending up from the bolsters and attached to the vertical leg of the plate, two in front and two behind. Those in front are bent to extend up the slope.

There is a single center partition between the two compartments. The cross-bearer web extends from the carline at the roof down to the angle-section bottom chords. These extend from the side sill to the center sill and are reinforced by a pressed-steel center-sill separator and a 6-in. crosstie plate under the sills. Angle connectors attach the web to the center sill.

The car side sheets are riveted to the side plates and welded to the side sills. The side plates are $4\frac{1}{16}$-in., 10.3-lb. Z bars continuous for the length of the car. Each side sill is in three pieces. From bolster to bolster, which is also the length of the side sheet, an angle is used. Extending from bolster to end sill at each end of the car is a 12-in., 20.7-lb. channel.

The side posts are all welded to the side sheets, except that the bolster posts are riveted to the ends of the sheets below the slope sheets. The bolster posts are 9-in. 15-lb. channels. The seven intermediate posts are pressed U sections the upper ends of which are closed by covers.

The ends are made up of channel end sills of the same section as the adjoining side sills. The end plate, corner and end posts are of angle section. All end and corner posts are attached to the end plate with gusset and riveted to the vertical web of the end sill.

The hopper compartments are made up of end slope sheets, crossridge slope sheets, inside and outside hopper sheets, the side sheets, and the center partition. Each end sheet starts at the roof carline at the end of the car and continues down to the hopper discharge gates, one on

each side of the center sill. It is welded to the side sheets, to the inside and outside hopper sheets and longitudinal hood. The bolster floor supports and reinforcing members are also attached by welding. The crossridge slope sheets are also welded to the partition sheet, the longitudinal hood, the side sheets and inside and outside hopper sheets. The longitudinal hood in each compartment is reinforced at mid-length by a transverse pressed plate.

The crossridge floor sheets are reinforced with angles welded to the sheets parallel to the longitudinal center line of the car and attached with gussets to the crossbearer.

The hoppers are closed by sliding gates which move longitudinally of the car. The gate frames are welded to the bottoms of the hopper sheets. The hoppers are also reinforced by angles at the sides level with the bottom of the center sills and across both ends by pressed-steel ties which extend across the car and are welded to the hoppers and center sills. Further reinforcement is provided by angles riveted to the center-sill webs and welded to the inside hopper sheets.

The roof is supported by angle-section carlines. The roof sheets are riveted to the carlines with closely spaced rivets and asphaltum paper is applied in all laps except at the side plate. The hatches, eight per car, are formed by welding and are riveted to the carlines. The hatch covers are hinged to swing toward the longitudinal center line of the car when opened. The four covers on one side are held closed by arms attached to a single locking bar.

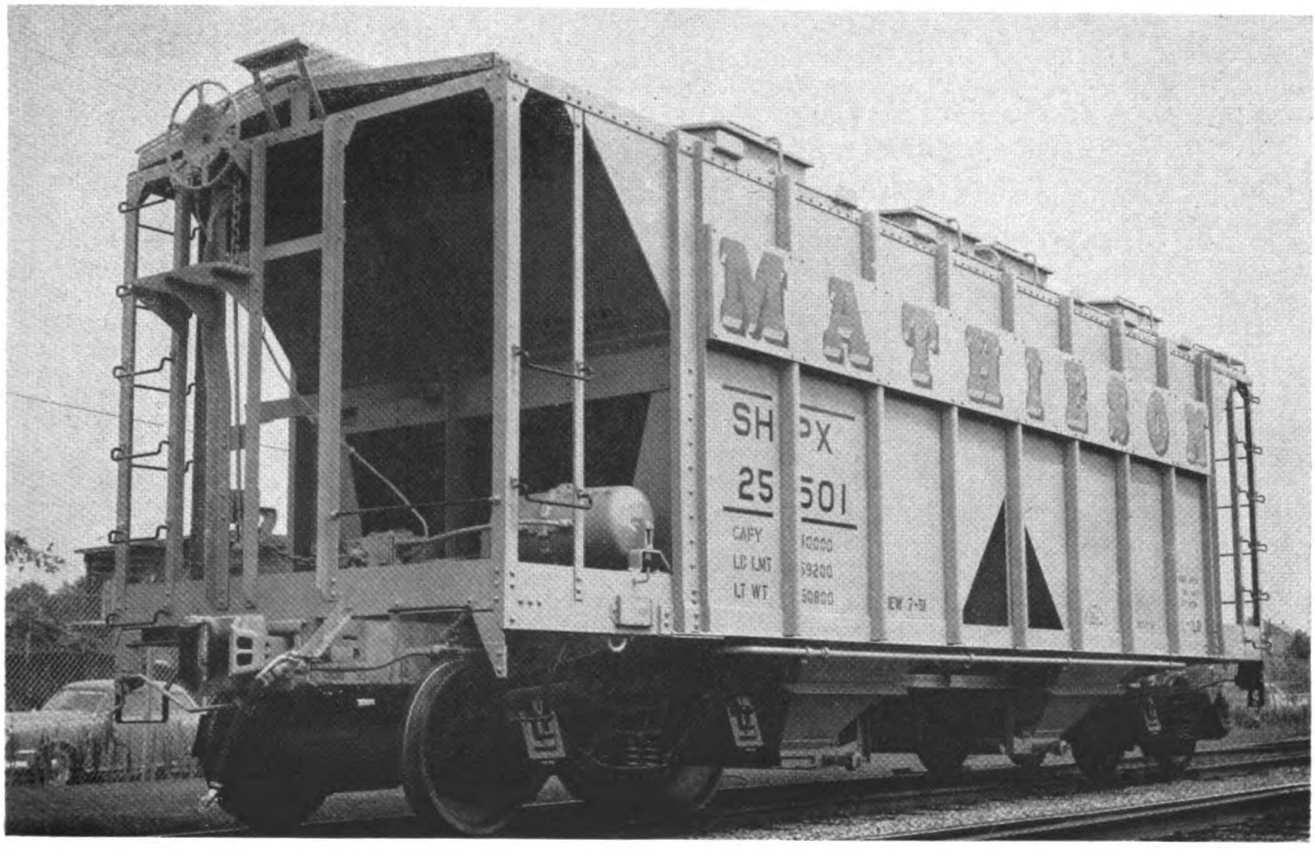
The materials in the car body, including sheets, bars, plates and strips ¼-in. thick and under the 5/16-in. side stakes are of Copper-bearing steel. Side and roof sheets are Nos. 7 and 11 manufacturer's standard gage steel, respectively. All slope and hopper sheets, including the crossbearer and partition, are made of ¼-in. plate.

The trucks are American Steel Foundries A-3 Ride Control spring plankless, with 2½-in. travel truck springs. The 33-in. one-wear rolled-steel wheels are mounted on axles with 6-in. by 11-in. journals. Both were furnished by Bethlehem Steel. Side frames and bolsters are Grade B castings. Springs and journal box lids are from the American Locomotive Company, Railway Steel Spring Division; the brake beams from the Chicago Malleable Castings Company, and the brake-hanger wear plates from Schaefer Equipment.

The cars are equipped with the AB brake furnished by Westinghouse. The brake rigging is designed to provide a braking power of 75 per cent of the light weight of the car at 50 lb. cylinder pressure, which is equivalent to 18 per cent braking power of the maximum rail load. Hand brakes are of the Miner vertical wheel type. Couplers are A.A.R. Type E, with 6¼-in. by 8-in. rigid shank. They are bottom operated.

THE PRINCIPAL DIMENSIONS OF SHIPPERS' CAR LINE 70-TON COVERED HOPPER CAR

Length inside of body, ft.-in.	29–3
Length over strikers, ft.-in.	35–3
Width over all, ft.-in.	10–1½
Height rail to top of running board, ft.-in.	12–9¾
Height rail to bottom of discharge outlet, in.	8
Slope of end floor sheet, deg.	50
Slope of crossridge floor slope sheet, deg.	50
Slope of side hopper sheet, deg.	48
Size of discharge openings, ft.	1-1/12 by 2
Size of roof hatch openings, ft.	3 by 3
Distance center to center of trucks, ft.-in.	25–3
Truck wheel base, ft.-in.	5–8
Capacity loaded to eaves, cu. ft.	1,958
Weight, Light (est.), lb.:	
Body	34,300
Trucks	16,400
Car	50,700



Resilient Pads Add to Comfort on Passenger Cars

By F. J. Carty*

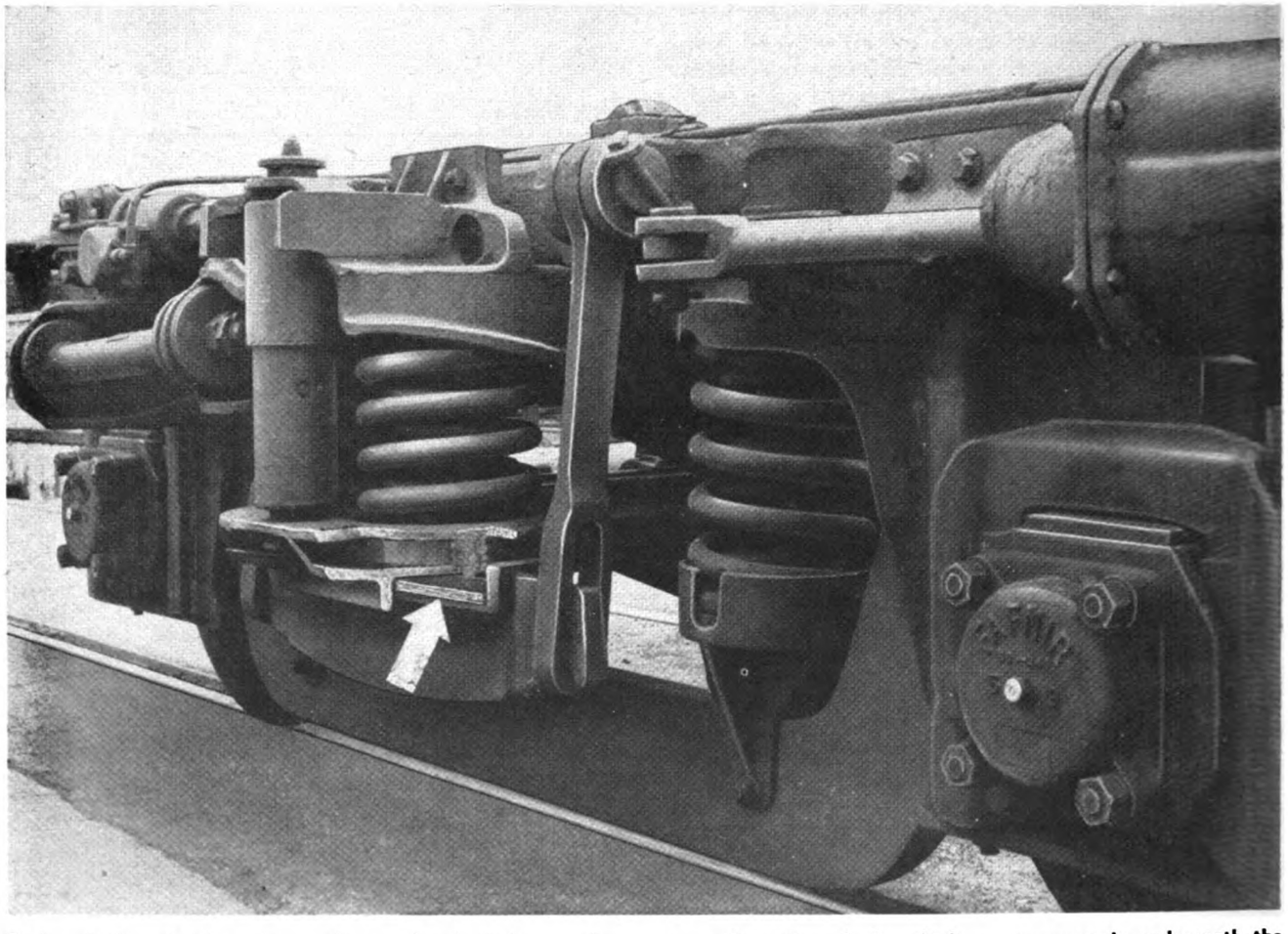
THERE are approximately 40,000 passenger train cars in service on Class I railroads in the United States. During a period of one year, well over 555 million revenue passengers are transported in these cars. Of course, safety is of primary importance in the operation of railroads, but the importance of providing attractive comfortable, easy-riding cars is self-evident as this results in increased passenger revenue.

To attain this desirable condition, many factors must be given consideration, but this article is limited to an outline of the proper utilization of resilient materials, in absorbing impact shocks, isolating high frequency vibration and abating noise on railroad passenger cars.

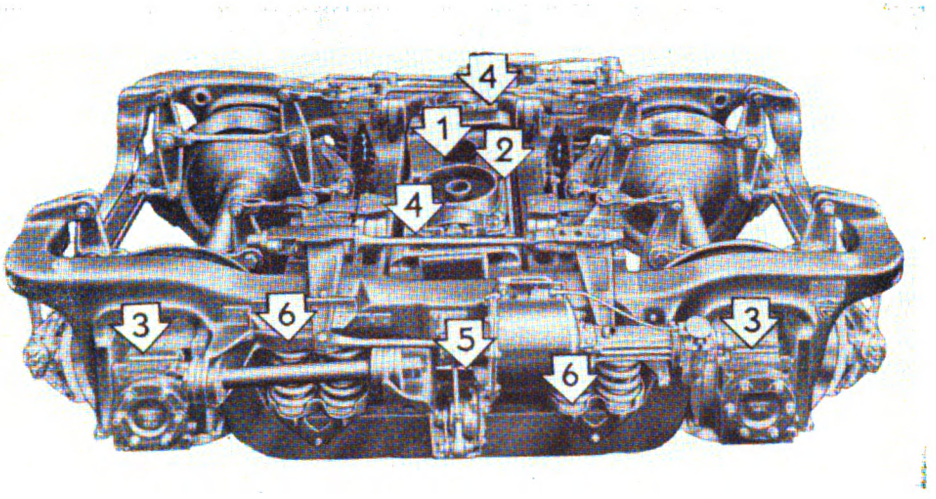
Modern passenger cars are designed to operate at speeds up to 100 m.p.h. and to traverse curves up to 18 deg. which are sometimes encountered in yards, although the maximum curvature of main line track seldom exceeds 6 deg.

When a car is in motion, the rolling of the wheels on the rail generates vibrations and rumble, and the wheels passing over rail ends, crossing frogs and switches sustain impacts or sudden blows. Such impacts also set up vibrations which are transmitted through the wheels, axles, journals, equalizers and springs to the truck frame and then through the transoms to the spring planks, bolsters and center plates to the car body. The major part of the

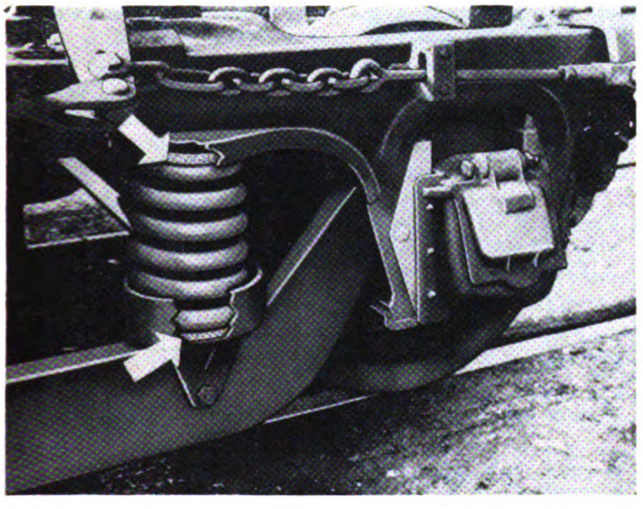
* Engineer, Fabreeka Products Company.



Spring-plank pads. On swing-motion trucks the bolster springs rest on the spring planks which run transversely underneath the bolsters and are suspended from the transoms by hangers passing under the sprink planks. Spring-plank pads are applied between the top surfaces of the fillers and the bottom of the spring plank. The pads are held in position by downwardly projecting lips of the spring plank



Below: Equalizer and bolster coil-spring pads. Resilient pads are installed at the top and bottom of bolster and equalizer coil springs to reduce metal fatigue and spring breakage and to improve the riding quality of the car



Above: The six principal applications of resilient pads to new passenger car trucks are (1) top and bottom bolster coil springs; (2) center plate; (3) top of journal boxes; (4) under truck side bearings; (5) under spring planks; (6) top and bottom equalizer coil springs. To absorb impact shocks effectively, isolate vibration and reduce noise, the sum of the thicknesses of resilient pads installed at various points between the wheels and car body, should be at least 2½ in. Older trucks can be modernized by substituting resilient pads in place of the wooden or metal shims commonly used to maintain the height of the couplers within permissible limits

cushioning is accomplished by the springs, but as these are metal, high frequency vibrations are transmitted through them.

Lateral play necessary

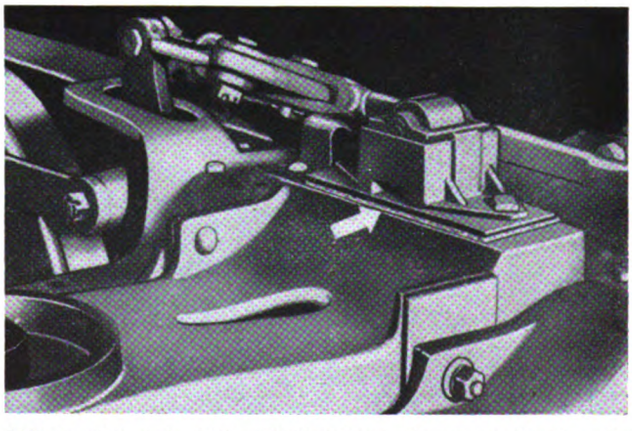
A limited amount of lateral play is necessary to prevent binding and to allow freedom of movement of truck parts, especially when a car is going around a curve, and it may be pertinent to note that approximately 10 per cent of main line track is curved. On account of the relative movement of the car parts, certain lateral impacts of considerable magnitude occur and these may be considered as acting in horizontal planes. Other impacts, sometimes severe, occur in a fore and aft direction, when there is a sudden change in the speed of movement of the train, due to handling of the engine, application or release of the brakes or when cars are being coupled together.

Unless such shocks are cushioned and vibrations isolated, they frequently result in discomfort to passengers, loose bolts, fatigue of metal, breakage of parts and increased cost of maintenance.

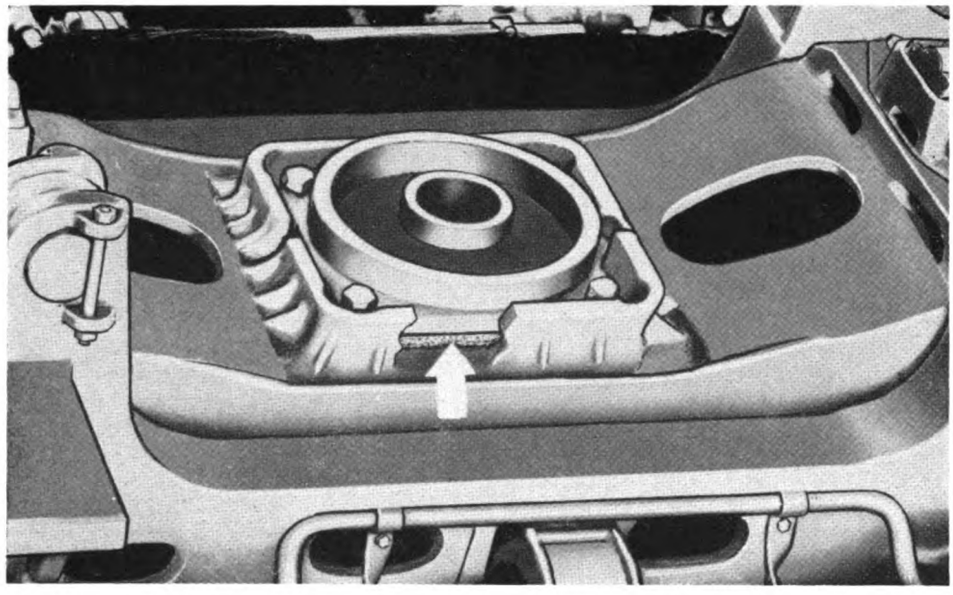
Recognized principles of vibration isolation as related to the use of resilient pads, may be considered as depending upon two primary factors: (a) The frequency of vibration to be isolated, that is the forced vibration due to periodic and continuing disturbing forces; (b) The natural frequency of the system, or the rate at which it would tend to vibrate after sudden release from external force.

The frequency ratio is the ratio of the forcing frequency to the natural frequency. If the frequency ratio is less than 1.41, the resilient mounting is of no value in isolation of vibration, and may be harmful if resonance results, which is the case when the forcing frequency equals the natural frequency. For good vibration isolation, the frequency ratio should be at least two and one-half.

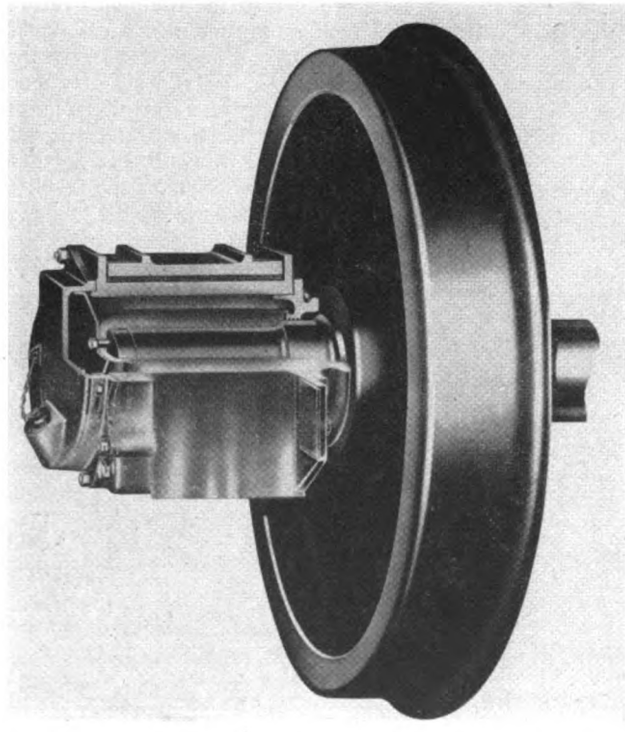
The elastic internal vibrations, which it is desired to isolate, and which are set-up in car parts as the result of impacts and by the rolling of the wheels on the rail may



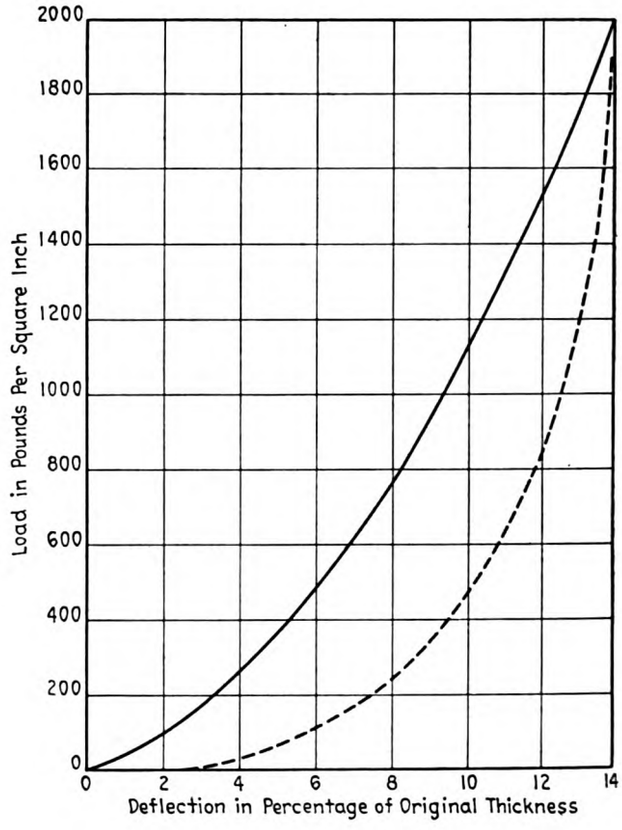
Side-bearing pads. Body side-bearing pads are attached to the body bolster on each side of the center plate to steady the car and prevent excessive rocking while the car is passing around a curve. The resilient pad is placed between the bottom of the side bearing and the top of the truck bolster. Truck side bearing pads are also used to cushion impact shocks, isolate high frequency vibrations and reduce noise



Above: Center-plate pads. It is the practice to design passenger-car truck parts for a center-plate load of 70,000 lb., which means that the pressure on center-plate pads is in the order of 300 or 400 lb. per sq. in. The efficiency of a resilient pad in the isolation of vibration varies directly in proportion to the thickness, but sufficient stability must be maintained. To obtain good service and long life from center-plate pads, they must not be subjected to abrasion; that is, the center plate in contact with the pad must not move horizontally with reference to the resilient pad



Journal-box pads. Resilient pads applied to journal boxes break metal-to-metal contact, cushion ends of equalizers, isolate vibration, reduce noise and, in the case of roller type journal boxes, protect the rollers and races from damaging shocks



Below: Load deflection curve. The solid line is the loading curve; the dotted line, the unloading curve

be assumed to have frequencies of over 100 cycles per second.

To absorb shocks, isolate vibrations and reduce noise, it is important to eliminate metal-to-metal contacts at certain points of the car body and trucks. Designers recognize that this can be accomplished successfully by interposing suitable resilient pads between the metal parts. Such resilient pads must be capable of dissipating energy in the form of heat and have mechanical resistance to vibration conductivity differing greatly from the metal parts.

To give effective and satisfactory service, resilient pads must retain original physical characteristics during long service life and must not be damaged by millions of cycles of loading and unloading. They are required to withstand the action of water, brine, heat, cold and weather conditions generally encountered in railroad service.

Resilient pads store up energy like a spring and when pressure is released, give up this energy without appreciable loss. Their value as vibration insulators depends on this characteristic property.

The measure of resilience is in terms of the energy to produce a deformation and may be judged by the ratio of energy given up on recovery from deformation, to the energy required to produce the deformation.

Load-deflection characteristics should be studied when determining the most suitable and efficient resilient pads for use on railroad passenger cars, as the loading and unloading curves in compression, indicate the ability of a pad to absorb energy. The deflection under load is one of the factors from which can be judged the effectiveness of the pad as a vibration isolator.

The stiffness coefficient and damping characteristics can be determined from the load-deflection curve. The stiffness of a resilient pad is indicative of the degree of deflection which may be expected when the pad is under load, and is a criterion of its value as an isolator. The stiffness coefficient of a resilient pad increases with decrease in thickness.

The progressive reduction of amplitude in free vibration is known as damping and in the case of rubber compounds considered as internal friction, which is inversely proportional to the frequency of vibration. Damping is a force which resists motion and the damping ratio is the ratio of any amplitude to the following amplitude. Experience has shown that resilient pads having a damping coefficient of approximately 1.6 give very satisfactory service on railroad passenger cars.

The set of a resilient pad is the permanent change of form due to repeated or excessive stress, and creep is the additional deformation occurring with elapse of time while the pad is under stress.

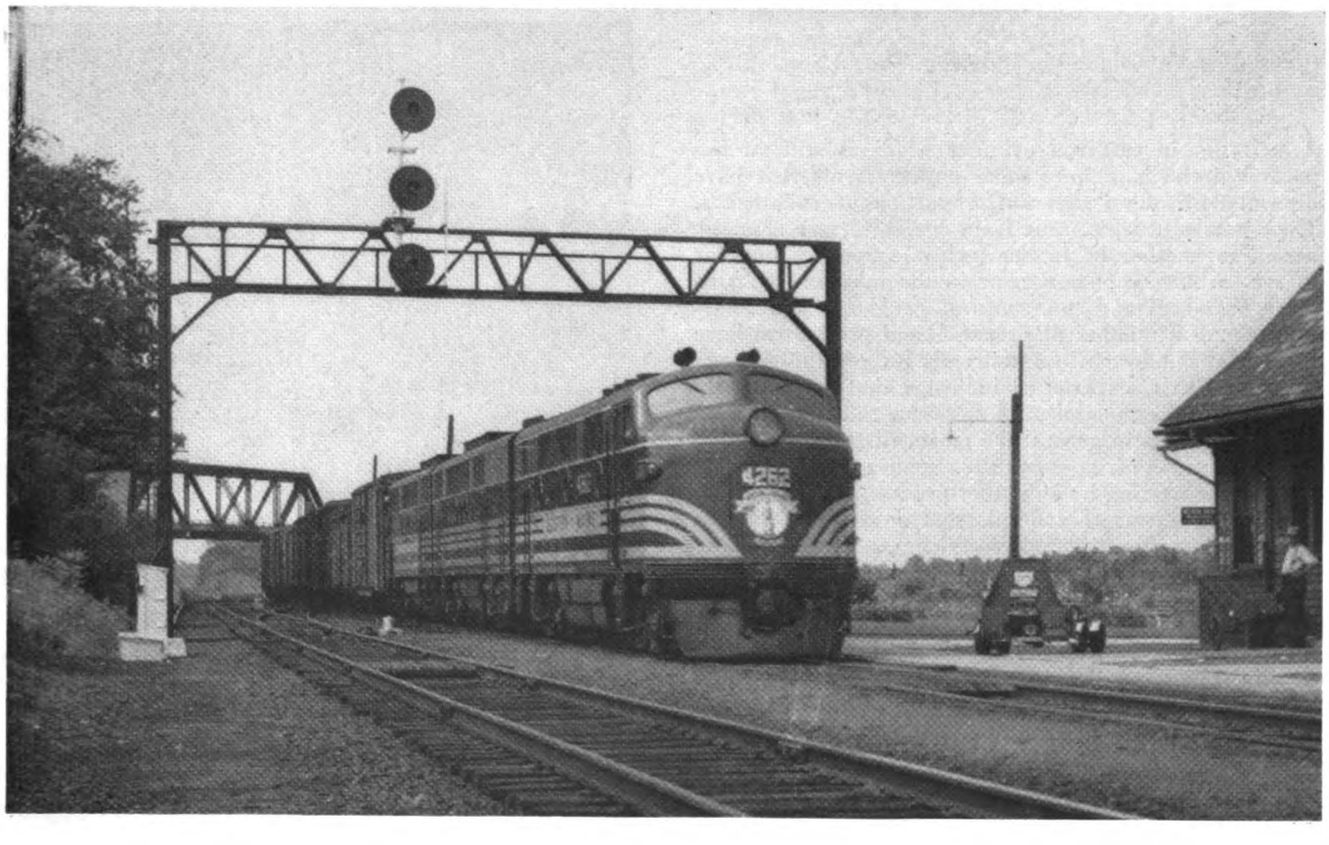
To give satisfactory service, resilient pads must retain strength, resilience, and flexibility and must not have excessive set or creep under heavy loads, as this would decrease the natural frequency and might result in loose bolts and misalignment of parts.

Excessive noise is objectionable as it has a detrimental effect on the nervous system of passengers and every practical effort should be made to eliminate it.

When the frequency of vibration is less than 15 oscillations per second, the vibration is a shake or tremor. Between 15 and 30 oscillations per second, the tremor is accompanied by noises or clicks. Vibrations having frequencies greater than 30 oscillations per second are recognized as sound, the amplitude of vibration determining the loudness and the frequency determining the pitch.

Breaking the continuity of the path of sound by interposing resilient pads between metal parts which are being caused to vibrate, is effective in reducing noise. This is one of the more important functions of resilient pads on railroad passenger cars.

The load-deflection curve shown is typical of an efficient resilient pad having a durometer hardness of about 90, composed of layers of tightly twisted, closely woven, light weight cotton duck. Each layer is thoroughly impregnated with a special rubber compound and the layers are built up to required thickness and vulcanized together.



Reclaiming Aluminum Diesel Locomotive Parts*

By La Motte Grover† and R. L. Rex‡

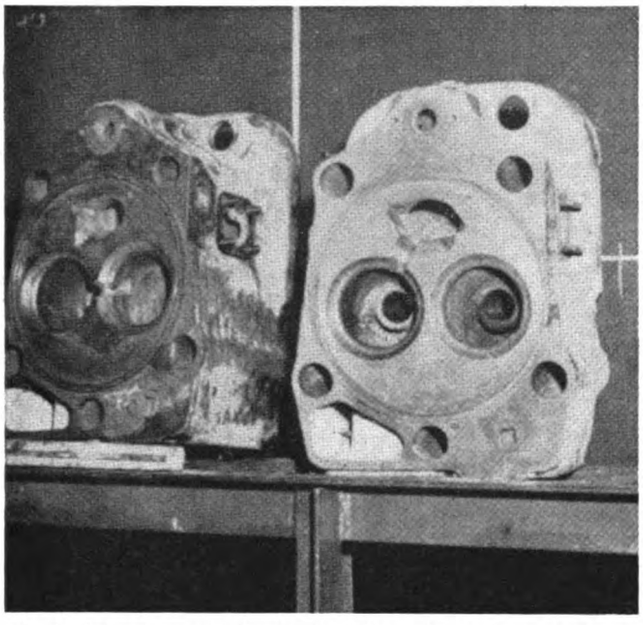


Fig. 1—Cast-iron cylinder heads with cracks veed out, preparatory for welding

CRACKING in cast-iron cylinder heads is still an important problem, despite some improvements that have been made in the design and proportions of such heads. These cracks usually occur from one valve seat (Fig. 1) across to another or to the fuel injection opening, or in the turbulence chamber, or in the inlet and exhaust valve chambers and sometimes at guide-bolt holes.

Although a number of processes and procedures have been tried out by various railroads for reclaiming such cylinder heads, experience indicates that oxyacetylene welding with a molybdenum cast-iron rod and suitable flux (Fig. 2), is in general the most satisfactory process, largely because of its versatility. Some cracks are inaccessible for welding by any other process, and when sand pockets or other rather deep-seated defects are encountered in the castings, the oxyacetylene process is the only one that affords an opportunity for the kind of manipulation of the rod and torch that is necessary for working out such defects.

Satisfactory results have been obtained by the tungsten-electrode inert-gas-shielded arc-welding process (using argon gas and either balanced a.c. current or d.c. straight polarity) for building up worn valve sets and for repairing cracks that are accessible, when no sand pockets or other deep-seated defects are encountered in the castings. However, one cannot foresee the encountering of such hidden defects. Also, it has been found that occasionally a crack that can be reached only with the oxyacetylene welding, is not detected until the heat of welding starts to open it up. Further, when the electrode holder must be inserted in an opening such as an exhaust valve chamber, to reach a crack or defect, the proximity of the surrounding highly preheated base metal will likely result in the holder being damaged by the heat.

The cracks may be veed out by grinding or machining prior to welding, or it may be found more expedient to wash them out with the torch while the welding is being done. Machined carbon plugs with land-shoulders are inserted in all valve openings and in the fuel injection opening, to dam off the deposited metal and to provide for

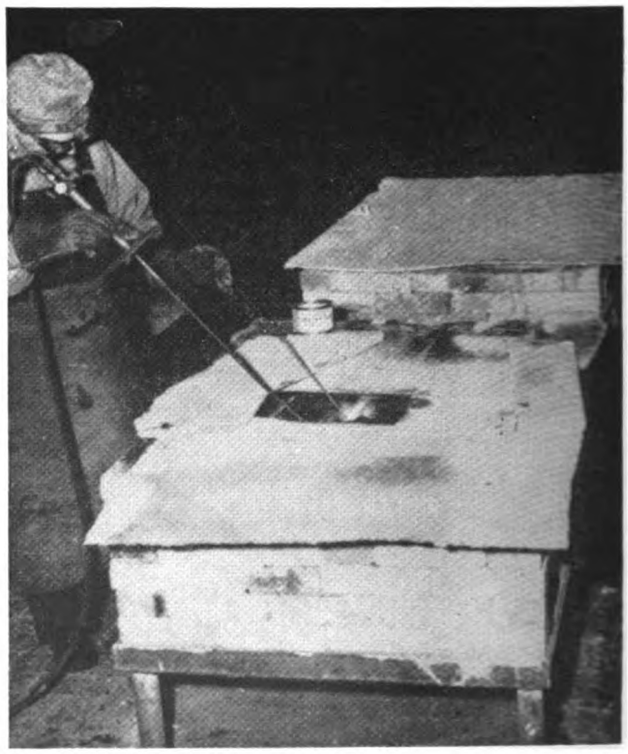


Fig. 2—Welding a cast-iron cylinder head in an insulated furnace which maintains the 1,400 deg. F. preheat temperature

* Part 2 of an abstract of a paper presented before the American Welding Society. † Welding Engineer, Air Reduction Company. ‡Superintendent of Railroad Service, Air Reduction Company.

sufficient build up of sound metal at the edges of such openings.

With either of these processes the cylinder is preheated to about 1,400 deg. F. and welded in an asbestos lined box or insulated furnace (Fig. 2), the preheating temperature being maintained during welding. The heads are then allowed to cool slowly over a period of at least 48 to 72 hours. Some shops use a longer cooling period. The gas-welded heads are sometimes left to cool in the box or furnace where they are welded, after flake asbestos has been packed around them, and the box or furnace covered. The heads that are welded by the tungsten-electrode method are reheated and then cooled slowly in the furnace or insulated box.

Although metal-arc welding with stick electrodes has been tried for reclaiming these heads, there appears to be no record of experience that would justify a departure from the long-established requirement for preheating and annealing, as outlined above, when welded cast-iron parts are to be subjected to such severe conditions and changes in temperature as those for a diesel head.

After cooling, the heads are machined on a radial drill press or vertical boring mill. Some types of heads require that the entire face be built up by welding to provide for subsequent machining because the general design is such that no appreciable departure from original dimensions can be tolerated.

The reclamation cost of such heads has been reported as varying from 10 to 60 per cent of the replacement cost, depending upon the type of head and the extent of the damage. Long service records have now demonstrated the success of this operation.

Various railroads have encountered no difficulty in setting up and carrying out these cylinder head reclamation operations in a successful manner, but it cannot be stressed too much that a shop should not attempt these operations without going into the matter right. Suitable and adequate equipment must be provided; correct procedures must be established and adhered to rigidly, and competent and specially trained operators must be developed; because there are some unusual techniques and manipulation that are needed at times to assure a dense, nonporous, machinable deposit, and to hold the warping of the cylinder head face to a minimum. In training operators for this work, it is well to start them out on scrap heads that are too badly damaged for reclamation.



Fig. 3—Arc welding new wear-resistant liners to roller-bearing journal boxes, while precision parts of the bearing are covered to protect them from spatter

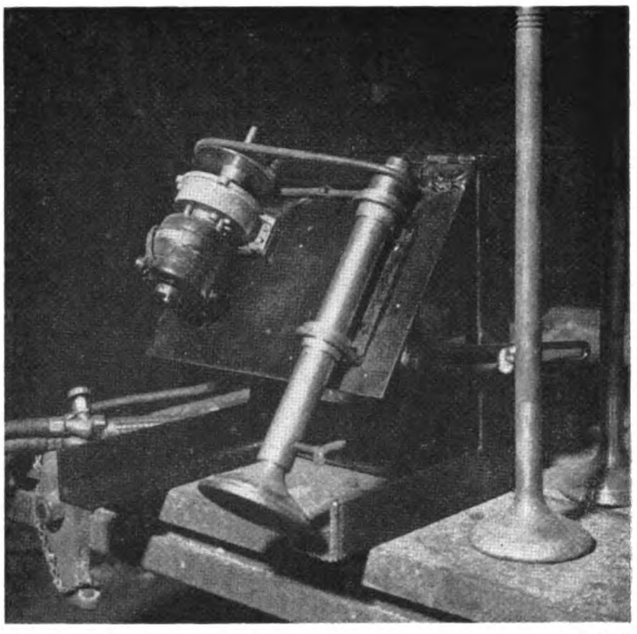


Fig. 4—Diesel valve (with a groove cut in seat on a lathe) mounted on a simple powered positioner for hard facing

Cast-Iron Cylinder Liners

When cast-iron liners of diesel cylinders become pitted on the water side of the liner, they are reclaimed by metal-arc welding, using an extruded electrode with a commercially pure nickel core wire. The welding is often done with little or no preheat, using a skip welding technique to avoid local overheating and to keep the heat balanced and distributed so as to minimize distortion.

The pitted areas are first cleaned out thoroughly to bright metal. This can be done most easily with a rotary file.

When the procedure and technique are controlled carefully, the out-of-round distortion after welding can be held to 0.001 in. or less, which is comparable to the tolerance for a new liner. With proper care to avoid excessive welding, no subsequent grinding is necessary.

One railroad has reported the complete cost of this operation as little more than one-tenth of the cost of a new liner.

Roller-Bearing Journal Boxes

Two important reclamation operations are now carried out quite widely on roller-bearing journal box assemblies, by means of arc welding: building up wheel thrust end bearings, and applying new manganese steel or high

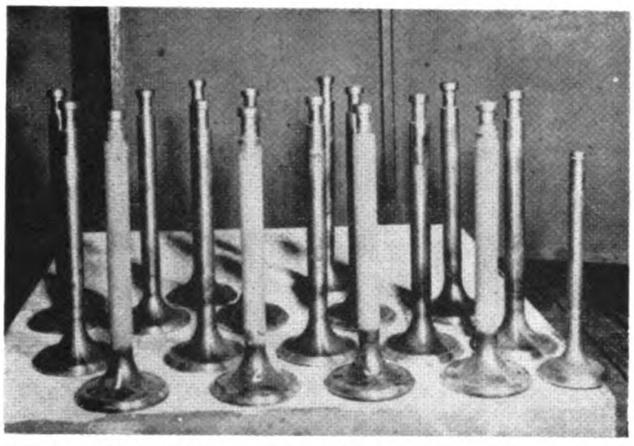


Fig. 5—(above) Valves of various sizes reclaimed by hard facing the seats. The four in the first row have also had the stems built up by metal spraying. Combining the spraying and facing permits efficient salvage of both stem and seat

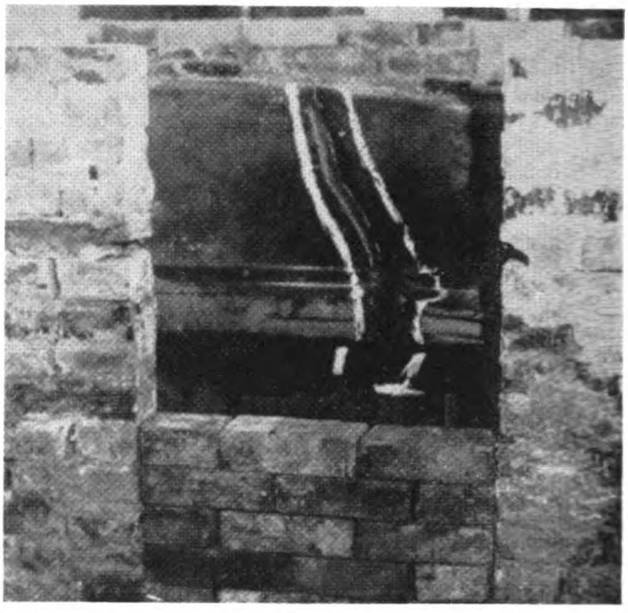


Fig. 6—(right) Broken diesel engine base in a preheat furnace. The break, outlined in chalk, is beveled and ready for brazing

carbon steel wear-resistant liners on the boxes or on the pedestal jaws of the trucks.

The process of rebuilding thrust bearings for Diesel roller-bearing journal boxes with a lead-bronze wearing face has been in use now for some three years with universally satisfactory results when the proper procedure is used. This process has been used successfully for a much longer period of time for driving box laterals of steam locomoitves.

The first procedure developed for these diesel thrust pads was patterned after the common practice used for driving box laterals. It involved the depositing of two or three $\frac{1}{8}$-in. layers of lead bronze on the worn face of the existing lead-bronze pad, using 200 to 300 deg. F. preheat and a $\frac{5}{16}$-in. lead-bronze self-fluxing bare electrode with about 225 amp. d.c. reversed polarity welding current.

The present trend in practice is to remove the old cast lead-bronze entirely, by the carbon-arc method, down to the cast steel, for the original reclamation, and to build up by arc welding with a phosphor-bronze electrode to within $\frac{3}{8}$ in. of the final standard surface contour, prior to depositing the facing of lead-bronze. This procedure facilitates control of porosity. A certain amount of porosity occurs invariably in depositing a lead bronze by welding, but experience has indicated no adverse effect of the moderate amount that occurs when proper procedures are used.

Subsequent reclamations, after the original reclamation, can usually be made by depositing one or two layers of lead bronze directly upon the worn face, following the original practice, at a cost of about 35 per cent of the cost of a new bearing.

Various other types of bronzes have been proposed and tried out for reclaiming these thrust bearings, but records of experience seem to indicate that these other types, such as the harder manganese and aluminum bronzes, are not suitable for this application.

In welding new manganese steel or high carbon steel wear-resistant liners to roller-bearing journal boxes (Fig. 3) or to the pedestal jaws of Diesel locomotive trucks (or to car trucks), the use of a 25-20 stainless-steel electrode has been common practice in the past. More recently there has been a trend toward the use of a mild-steel electrode with a low hydrogen-type coating which apparently is giving entirely satisfactory results at considerably less cost for electrodes. Further, the low hydrogen content weld metal is more easily removed by chipping, grinding, oxyacetylene gouging or arc cutting, during subsequent liner replacements.

Although the high-tensile strength and hardness of the liner plates, themselves, seems to have suggested to some reclamation departments that a high-tensile strength weld metal of high hardability, as well as low hydrogen content, should be used for this operation there is no apparent justification for incurring the additional cost of some 20 per cent for these electrodes over the cost of the mild steel low hydrogen type. Since the weld metal is deposited as fillet welds merely to attach the liners, the weld metal, itself, is not subjected to wear; so ductility rather than high hardness would be desirable for the weld metal.

In Fig. 3, it should be noted that a covering of some kind is provided to protect the precision parts of the bearing from damage by spatter during the welding.

In connection with the depositing of lead bronze, it should be mentioned that this has been done to a limited extent for restoring lateral-bearing surfaces of traction motor support bearings. After the motor has been completely stripped of windings, armature and other electrical parts, the motor case is set on one end, submerged in water almost up to the end of the collar of the bearing, to keep the rotating bearing part cool while the thrust part is being built up with lead bronze.

However, if the bore or rotating bearing part is badly worn, the entire bearing would be replaced rather than reclaiming the thrust part.

Another operation of reclaiming parts of bearing assemblies is that for traction-motor armature bearing housings, including the commutator-end bearing housing and the pinion-end housing, which work out of shape due to impact, and therefore must be rebuilt and machined to bring them back to standard. A departure of 0.003 in. or more from standard dimensions causes trouble with the armature shaft. These steel housings are rebuilt with an arc-welded deposit of mild steel.

Diesel Engine Valves

Oxyacetylene welding with a low-carbon chromium-cobalt-tungsten, nonferrous alloy has proved to be the most satisfactory process for rebuilding the seats of Diesel valves (Fig. 4). Service records show that such reclaimed valves give 3 to 3½ times the service life of a new valve. Several railroads have proposed to hardface new valves in this manner, before they go into service, because the use of such reclaimed valves has been found to cause no greater rate of wear on the seats in the cylinder head. In fact, the experience of some railroads is that with the use of reclaimed valves, the seats in the head require only grinding in, whereas previously they had required reseating, because of damage that had been caused by worn or distorted valve seats. As a result, these railroads now rebuild all valves by this welding process at the time of first removal of heads for inspection.

A saving of 50 per cent or more in cost has been reported for the reclaiming of these valves, as compared with the cost of new ones.

It is very important that valves to be reclaimed be inspected properly and carefully for cracks before welding. If such cracks exist they can result in serious failures which are sometimes improperly blamed upon the welding. When valve stems are badly worn, they may be turned down in a lathe and then built up with 0.80 carbon steel by metallizing after which they are finished by grinding to standard dimensions, thus making the reclaiming of the valve seats worthwhile.

Engine Bases, Frames and Bodies

In repairing heavy cast-iron structural parts such as engine bases, the general practice is much the same as in the repair of heavy cast-iron parts such as frames of steam locomotives. Braze welding with an oxyacetylene torch has been found to be the most economical process that will afford reliable performance under the usual service conditions and temperatures for such structural parts.

The braze-welding procedure and technique are relatively simple, as compared with gas welding with a cast-iron rod, and therefore braze welding is less critical in application. It has the further important general advantage that a part may often be braze welded, using local preheat, without removing it, whereas gas welding with a cast-iron rod would require that the part be removed for preheating, welding and subsequent slow cooling in a furnace of some kind.

In the case of cast-iron Diesel engine base with a fracture repaired by braze welding, a furnace (Fig 6) was built around the entire base (to preheat to 900 deg. F. with a charcoal fire) and the additional cost of using a cast-iron welding rod with suitable procedure and preheat would not have been as great as it is in many other cases. However, control of the welding operations would have been more critical, and more time would have been required. The physical properties of the braze-welded joint proved to be adequate for the service conditions.

For the repair of damaged steel side frames, underframes, sheeting and other steel body parts, arc welding with ordinary mild-steel electrodes is usually the most suitable and most economical process to use. However, at points where heavy material must be welded under a considerable amount of restraint against weld shrinkage, electrodes with coatings that produce low-hydrogen content weld metal can sometimes be used to good advantage.

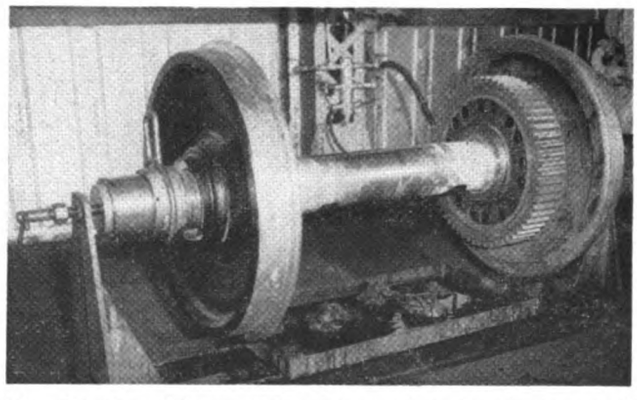
Mild-steel electrodes of Class E6010 or E6012, would be used ordinarily, except in some cases where a butt weld (groove weld) has to develop the full tensile strength of comparatively thick parts of high-strength low-alloy steel. For such cases the use of Class E7010 or E7011 electrodes is frequently recommended. However, it is well to recognize that fillet welds of minimum practical size, made with the less expensive mild-steel electrodes, often will be adequate for the strength requirements. Also, butt welds in thinner material usually pick up enough strength from the low-alloy base metal, to give them adequate strength. When welding must be done at rather low temperatures or with a considerable amount of restraint against weld shrinkage, the use of electrodes that provide a mild steel deposit such as Classes E6010, E6012 or E6016 facilitates control to prevent cracking, as compared with the use of the E7010 to E7011 electrodes.

In most cases of repairs of this kind, the reclamation of the parts can be carried out at a fraction of the cost of replacement, at the same time saving the cost of delays in waiting for replacement parts which are not often available.

Miscellaneous Items of Reclamation Work

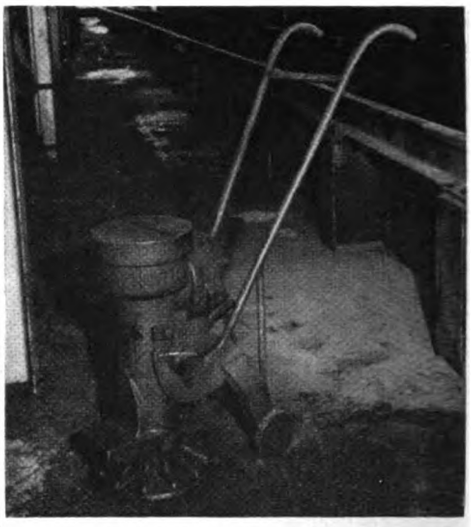
As the railroads have become more familiar with Diesel locomotive maintenance problems, applications of welding and the oyacetylene cutting processes have been expanded continuously to include not only the reclamation of major parts such as have been discussed, but also to include many minor items of routine work. Typical of these items are the use of arc welding with a low-alloy chromium-manganese type of electrode to hard face Diesel brakeheads, the use of silver soldering to repair radiators and copper or brass tubing of oil and water lines, and the use of a straight head cutting torch for the removal of pinion gears from Diesel motors when nondestructive methods fail and various other uses of these processes.

The reclamation of Diesel locomotive parts is continually opening up new profitable fields of application for most of the arc welding and oxyacetylene processes. It is especially interesting to note the ever-increasing applications that are being developed for the inert-gas-shielded arc-welding processes, including the newer metal-arc process with consumable filler-wire electrode, as well as the tungsten-electrode process.

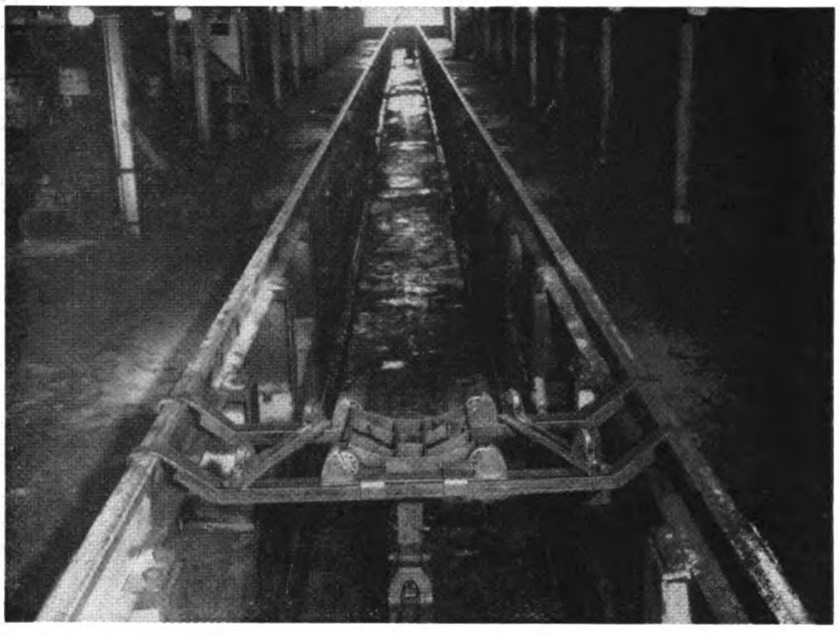


The cleaning of locomotive parts so that they be inspected and worked on in the shop is an increasingly important matter with diesel power and the Southern Railway has solved this problem with respect to diesel wheel sets at the Spencer, N. C. shops by a special stand on which nose suspension bearings are also honed

Shop Ideas from the Kansas City Southern

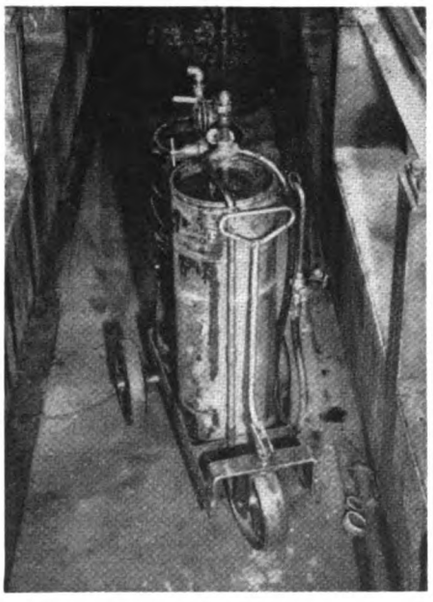


▲ A dolly which moves jacks up to 150-tons capacity

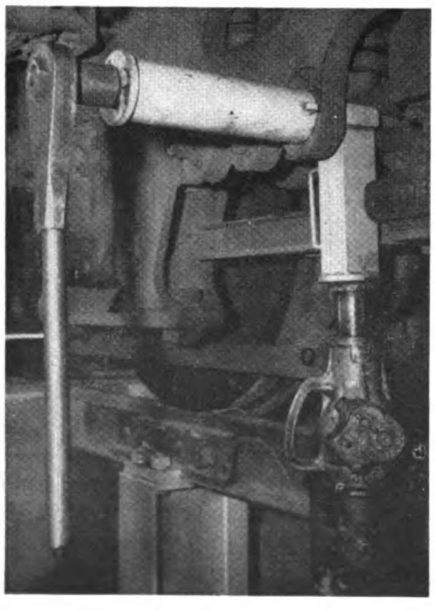


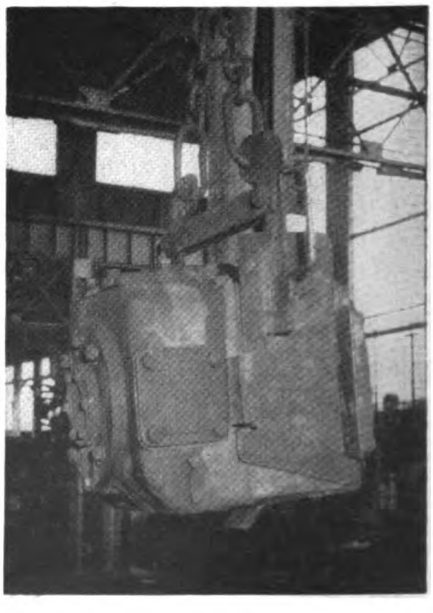
◀ Both transversely and longitudinally mounted air reservoirs, as well as the drums mounted in the nose of E.M.D. A-units, are removed and tested with the above apparatus at the Pittsburgh shops. The body-mounted reservoirs are removed with the cradle shaped to the reservoir contour which is mounted on the shaft of the step jack and which is positioned by a pin for different ranges. Removed longitudinal drums rest on the center rollers for testing. Transverse drums rest on the other set, shown lying slantwise. The latter rollers are also used to test nose-mounted drums in place

▼ Gib removal on Fairbanks-Morse trucks to replace the equalizer coil spring, which formerly required several hours, has been reduced to less than one hour with this apparatus. The member on top of the jack is slotted to fit around the gib with sufficient clearance to permit the jack to compress the spring enough to free the gib. A nut is permanently welded to the gib to permit its removal by the screw puller at the left

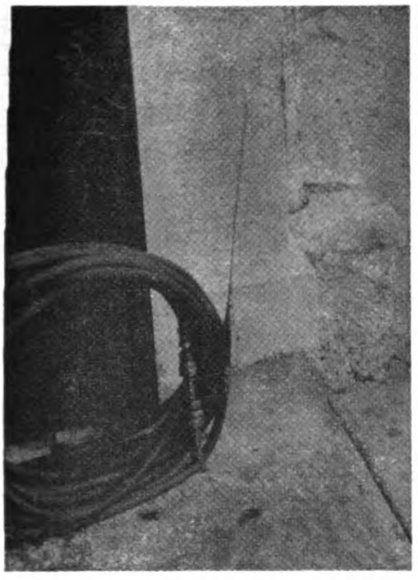


▼ A journal-box lifter with lips that catch under the lateral jaws to hold the box square and prevent turning

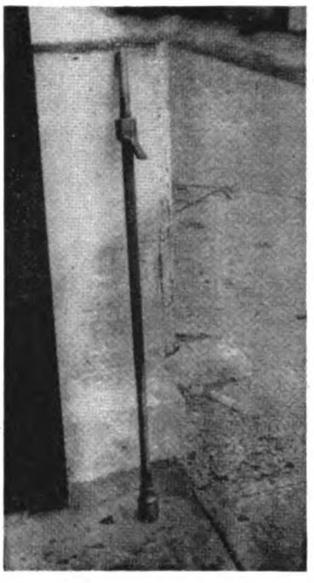




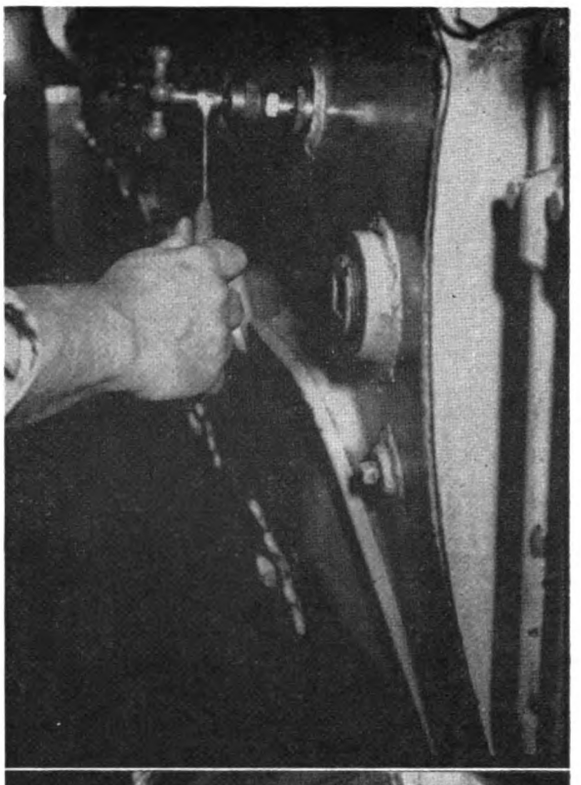
▲ Traction-motor-support-bearing changers are located permanently in the pits at the Pittsburgh diesel house and are moved back and forth to where they are needed. One of the drums contains air at 80 lb., which is piped to the second, containing the oil, through a reducing valve which maintains a pressure in the oil-discharge drum from 12 to 20 p.s.i.

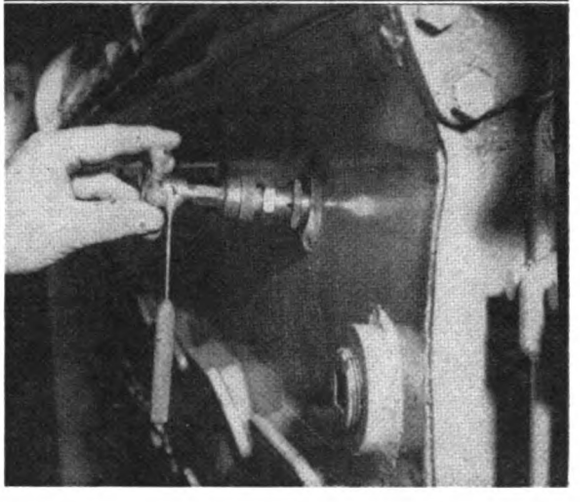


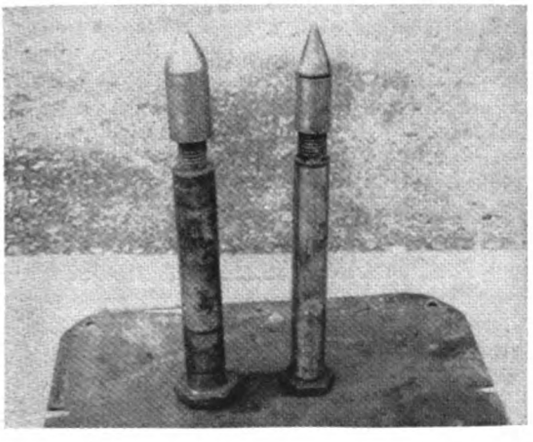
➤ The ⅛-in. tubing on the end of the rubber hose blows the oil away from the leakage area of an injector in place on a locomotive so that the leak may be seen



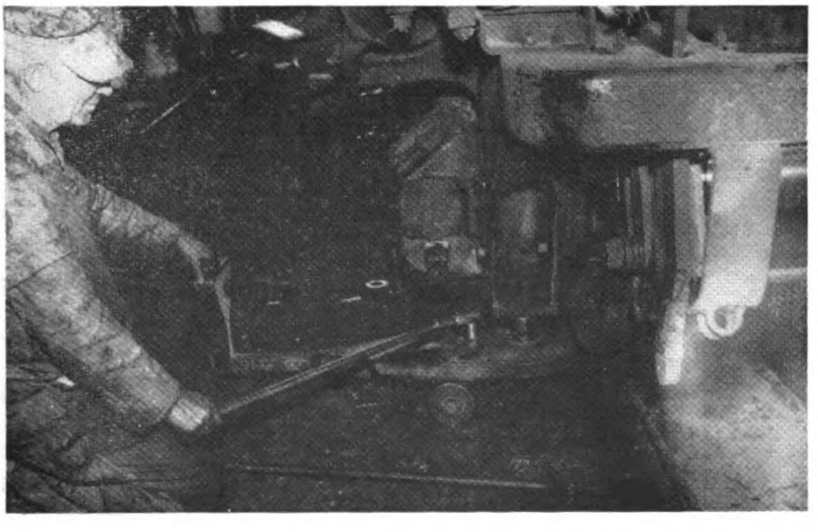
▼ Internally threaded cone-shaped devices are put on the end of brake pins to slip the pin through the brake rigging parts, eliminating the need for using a drift pin







▲ A gadget for removing safety hanger nuts. The wrench extension consists of a socket mounted loosely on the handle with a cotter key to take care of slight angular irregularity



▲ A wrench which permits quick removal of relief valves. The handle has an internal hexagon shape which slides over the hex-shaped portion of the handle for final tightening or initial loosening as shown above. During other operations in the removal or application of the relief valve the hex handle slides back over the round part of the shaft below for spinning the valve in or out with the hand wheel

➤ Binder nut remover has 7:1 reduction gearing and is turned with a ratchet wrench

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Main Frame and Base

288-Q.—What is the purpose of the doors located in the sides of the main base? A.—For inspection work on crankshaft, bearings and other parts.

289-Q.—How does the main base function? A.—The main base also serves as a lubricating oil reservoir for the diesel engine.

Oil Slinger

290-Q.—Where is the oil slinger located and what is its purpose? A.—It is located at the generator end, bolted to the generator adaptor. Its purpose is to prevent oil from leaking by the engine crankshaft into the generator and fan.

291-Q.—How does the oil slinger operate? A.—Centrifugal force throws the oil from the crankshaft into grooves machined in the slinger where it is collected and drained back into the base.

Generator Adapter

292-Q.—Where is the generator adapter located and what is its function? A.—It is mounted on the generator end of the engine and supports the main generator.

293-Q.—What is housed in the generator adapter? A.—The camshaft idler, camshaft gears, supports the oil slinger and carries a portion of the engine weight.

294-Q.—What is mounted on the adapter? A.—The tachometer generator, crankcase exhauster, and lifting eyes for removing the engine from the locomotive.

Engine Turning Device

295-Q.—What is the turning device for and where is it located A.—The engine turning device is for the purpose of rotating the engine by other than its own power and is located at the free end of the engine.

296-Q.—What does the turning device consist of? A.—It consists of two principal parts, the worm assembly and the gear assembly. The worm gear is keyed to the crankshaft extension and secured by a lock washer and nut and the worm assembly is bolted and dowelled to the supercharger support.

297-Q.—How can the engine be rotated? A.—The ends of the worm shaft terminate in a hex on which a hand wrench or motor may be applied so that the engine can be rotated from either side.

298-Q.—How is the turning device engaged? A.—To engage the worm with the worm gear hold the lifting lever and unscrew the locking bolt until the housing is free. Lower the assembly carefully until the gears have made contact, turning the worm slightly if necessary, to get the teeth to mesh. Re-apply the bolt and tighten.

299-Q.—What serves to lock the device in engaged position? A.—The pressure exerted by the spring against the bolt effectively locks the device in engaged position.

300-Q.—How is the timing device dis-engaged? A.—Unscrew the locking bolt until the housing is free. Swing the assembly upwards until the bolt lines up with the threaded hole on the right side of the housing. Lock it in this position with the bolt securely tightened.

301-Q.—What precaution must be taken? A.—Do not start the engine with the turning device engaged.

302-Q.—How is the turbosupercharger support constructed and what is mounted on it? A.—The turbosupercharger support or upper end casing is of steel welded construction. On it is mounted the supercharger, turning device and governor.

Vibration Damper

303-Q.—Where is the torsional vibration damper located and what type is it? A.—It is attached to the end of the engine crankshaft opposite the generator end. This damper is of the viscous type in which some of the vibration energy is absorbed by the work done on the viscous fluid in the damper.

304-Q.—What does the damper consist of? A.—It consists of a hub member with a casing welded to it in which is enclosed a free fly wheel surrounded by silicone fluid. As the damper is completely sealed it requires no servicing.

Lower Casing (Free End)

305-Q.—Describe the lower casing (free end). A.—It is of steel plate welded construction and is located directly below the turbo supercharger support. When these two parts are assembled on the engine they form a housing for the crankshaft accessory gear and damper.

306-Q.—What is supported by the lower casing? A.—The engine water pump and lubricating oil pump and necessary gears to drive the pumps.

Gear Trains

307-Q.—Where are the gear trains located? A.—At both ends of the engine.

308-Q.—How do they function? A.—The gears at the generator end make up the timing gear train which drives the camshafts and governor tachometer generator. The train at the free end drives the lubricating oil and cooling water pumps.

309-Q.—What do the camshaft timing gears mesh with? A.—The helical camshaft timing gears mesh with idler gears engaging the crankshaft gear.

310-Q.—How are the camshaft gears applied? A.—They are keyed and mounted on a tapered fit at the end of the camshaft and are secured by a hex nut bolted and lock-wired in place.

311-Q.—Describe the crankshaft gear. A.—It is of the split type having an upper and lower half, mounted on the crankshaft.

312-Q.—What does the left bank camshaft gear drive? A.—The governor tachometer generator gear assembly.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

CRANKSHAFT GEAR (FREE END)

313-Q.—What does the gear train at the free end consist of? A.—A crankshaft gear mounted on the extension shaft, lubricating and cooling water pump drive gears. The gears for both pumps are mounted in a housing attached to the lower gear casing.

314-Q.—How are the pumps driven? A.—The pumps are both driven from their respective gears through a spline arrangement.

315-Q.—Where is the crankshaft timing disc located? A.—It is integral with the worm gear for barring the engine and is mounted on the crankshaft extension just outside the free end casing.

316-Q.—Describe the timing disc. A.—The face is engraved with a line every degree for its entire circumference. The positions in line with the various crank throws are marked by numbering the applicable throw; thus, 1 and 8, 2 and 7, 3 and 6, and 4 and 5 are engraved at their respective positions. Attached to the casing are two pointers 45 degrees apart and marked L.H. and R.H., indicating the top dead center positions of the two cylinder banks.

Schedule 24 RL
Air Brakes

TRAIN CONTROL OPERATION (CONTINUED)

1182-Q.—Describe the connections made and flow of air resulting when the handle of the DS-24 Brake Valve is moved to service position to reduce brake pipe pressure and thus suppress a train control application. A.—The brake valve rotary valve connects passage *15* from the equalizing discharge valve to passage *17*, pipe *17*, passage *17* in the *A-1* Suppression Valve, by check valve *28* and choke fitting *4* to passage *27*, pipe *27* to rotair valve (if used), through rotair valve seat into pipe *7* and the timing reservoir (rotair valve in FRGT position), charging this reservoir.

1193-Q.—In what other way is the timing reservoir connected? A.—To Chamber *A* on the left face of the A-1 Suppression Valve cut-off diaphragm *57* through passage *27* by the reduction insuring valve *32*, through choke fitting *35* into passage *26* by double check valve *16* and into chamber *A*.

1184-Q.—What other connection is made with the brake valve rotary valve in service position? A.—Brake pipe air is connected to the A-1 Suppression Valve diaphragm *57* through passage *2* and *26* in the brake valve, pipe *26*, passage *26*, by double check valve *16* into chamber *A*, also through choke *35* to atmosphere choke *36* and passage *27*.

1185-Q.—What movement then takes place? A.—Cut-off diaphragm *57* will move to the right compressing spring *29* and allowing suppression cut-off valve *80* to close.

1186-Q.—What results from closing cut-off valve 80? A.—This prevents venting of air from the brake application piston *112* through passage *10*, pipe *10*, pipe *4*, timing valve pipe *5*, pasage *6* of the A-1 Suppression Valve by cut-off valve *80* into passage *42* and the stop reservoir to permit a temporary suppression of a train control application.

1187-Q.—What happens if the automatic brake valve is placed on lap? A.—After the brake valve is placed on lap, the brake pipe air is cut off from the suppression valve pipe *26* but will continue to reduce past the equalizing discharge valve until it is less than the pressure in the equalizing reservoir.

1188-Q.—What is the movement after the equalising valve closes? A.—As the brake pipe pressure drops after the discharge valve closes, the automatic timing reservoir pressure drops with it, down to *35* lbs., through spring loaded check valve *23* back into passage *17*. At about *35* pounds, check valve *23* seats.

1189-Q.—What then will be the result? A.—A train control application.

1190-Q.—Explain how a train control operation is brought about. A.—It will require about 10 seconds for the pressure on the cut-off valve diaphragm to reduce approximately *11* pounds, which will allow cut-off diaphragm *57* to move toward the left, open cut-off valve *80* and cause a train control operation.

1191-Q.—How can additional temporary suppression be obtained? A.—Further reduction of brake pipe pressure will permit additional temporary suppression.

1192-Q.—What happens if the rotair valve is in PASS position? A.—First suppression and timing reservoirs are cut out.

1193-Q.—Is temporary suppression available? A.—Only in service and lap positions while the brake pipe exhaust is blowing.

1194-Q.—What will cause a permanent suppression? A.—A full service reduction.

1195-Q.—Explain how this is accomplished. A.—Brake pipe pressure in chamber *C* will reduce enough for suppression reservoir *19* pressure in chamber *D* to move reduction insuring valve *32* and connect brake pipe *1* through the reduction insuring valve to passage *26*, choke *35* and double check valve *16* to chamber *A* and permit a permanent suppression in either freight or passenger service.

1196-Q.—With the rotair valve in FRGT position and first service position of the brake valve used, can a temporary suppression be obtained? A.—Yes.

1197-Q.—Explain how a temporary suppression is obtained under the above conditions. A.—The first suppression reservoir is conected to chamber *A* of the A-1 Suppression Valve through passage *33*, rotair valve seat, passage *23*, pipe *23*, passage *22*, rotary valve *216*, passage *26*, pipe *26*, by double check valve *16* and into chamber *A* closing cut-off valve *80* and causing a temporary suppression.

1198-Q.—What will happen in about 20 seconds if authorized speed or clear signal do not prevail? A.—A train control application will occur.

1199-Q.—Explain the action taking place to cause a train control application. A.—The air also flows through choke *35* and reduction insuring valve *32* to exhaust choke *36*, which in about 20 seconds (with brake pipe pressure at *70* pounds) will reduce the pressure in chamber *A* enough to allow spring *51* to open cut-off valve *80* and cause a train control application.

1200-Q.—What must be done at the end of 20 seconds time if a restricted condition still exists? A.—The brake valve handle must be moved to service position for further partial or permanent suppression depending upon the amount of brake pipe reduction.

ELECTRICAL SECTION

Diesel Wheel Slippage*

New York Central's investigation indicates that a considerable saving in damage to locomotive equipment can be realized by providing the engineman with reliable indication of wheel behavior

By F. Thomas†

THE New York Central has been conducting an investigation of diesel wheel slippage that has continued since the early part of 1946. During this period, much valuable data has been accumulated and a number of railroads have been sufficiently interested in the results to ask for copies of the data. This paper is intended to give a resume of the tests and answer the many requests for information concerning them.

The investigation of wheel slippage was started when analysis of unexplained motor difficulties, flashovers and other troubles associated with the tractive equipment of our diesel-electric locomotives pointed to wheel slippage as a contributing factor. There were numerous observations of loss of power on the ammeter that were eliminated by momentarily notching back the controller,—indicating that wheel slippage existed, even though the wheel slip light did not operate. There were other instances on the road where the wheels were observed to be slipping without causing an operation of the wheel slip light.

To check further on the possibility of wheels slipping without operating the wheel slip control circuit, we examined a number of tapes from speedometers driven by power axles of freight locomotives. The wheel slip relay in use on the units at that time obviously did not function on many of these slips. There were also cases where severe rail damage occurred, because enginemen permitted wheels to slip unknowingly while trying to start a train.

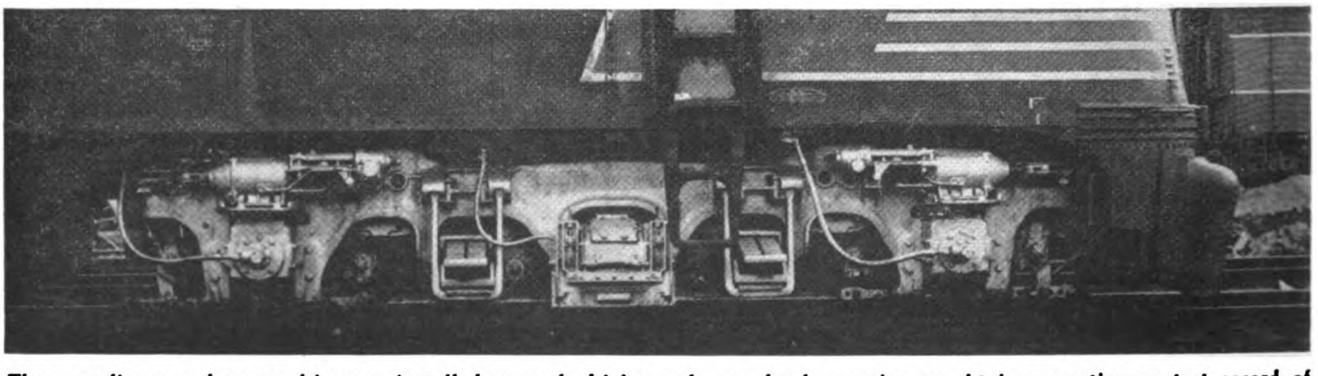
The next step in the investigation,—about September, 1948,—was to change the drive of the recording speedometer from the idler axle to the No. 1 power axle on two passenger units for test observation. It was assumed this pair of wheels had frequent slippage and would give a good speedometer tape record of any slipping condition. The records of wheel speed during the next several months showed that the extent of wheel slippage was even greater than expected.

There were numerous instances in regular service where the slipping wheel spun to speeds in excess of 120 m.p.h., which was the highest the recorder would register. Continuous slippage at such speeds occurred for distances as great as 34 miles as measured on the tread of the slipping wheel. Recorder tapes were obtained where a pair of slipping wheels in effect traveled as much as 60 additional miles in a single division of 146 miles.

Continuing the investigation, a second recording speedometer was added to the diesel units at the axle powered by No. 2 traction motor, (March, 1949). This recorder was equipped with an extra pencil to register operations of the wheel slip light circuit. From the second recorder,

* Paper presented before the Locomotive Maintenance Officers' Association, Chicago, Ill., September 17-19, 1951.

† Assistant to General Superintendent, Equipment, Diesel-Electric, New York Central.



The recording speedometer drives as installed at each driving axle on the locomotive to obtain a continuous test record of wheel behavior. (Locomotive No. 4026)



One of the diesel locomotives used in connection with the New York Central wheel slip investigation

it was possible to determine whether or not simultaneous slippage of driving wheels in the same truck occurred frequently. This was found to be the case. It was also determined that the wheel slip circuit often did not function and no light warned the engineman.

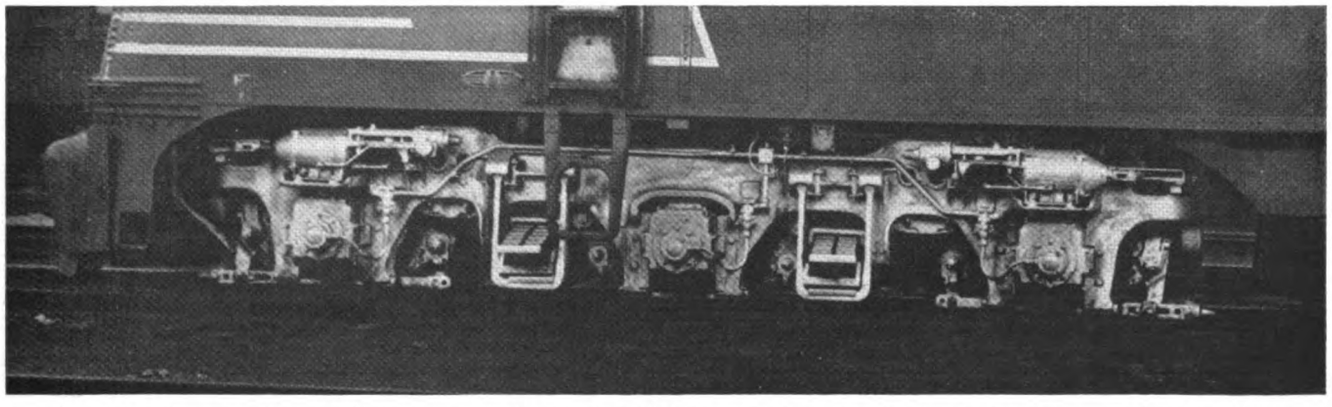
The above phase of the investigation extended from early 1948 through 1949, and in August, 1950, the other two driving axles of the diesel units were equipped with recording speedometers. Throughout the investigation, considerable work has been done on a number of types of wheel slip relays and their connections. In fact, the New York Central has tried all the slip relay combinations suggested by manufacturers. At present, there are more than 20 diesel units on the New York Central operating with experimental wheel slip relays.

While some improvement has been obtained in wheel slip detection, the results are still far from satisfactory by this method, particularly at high speeds. We have about reached the conclusion that the sensing of wheel slippage by relays in the motor circuit is fundamentally unreliable for certain conditions, including wheel slide.

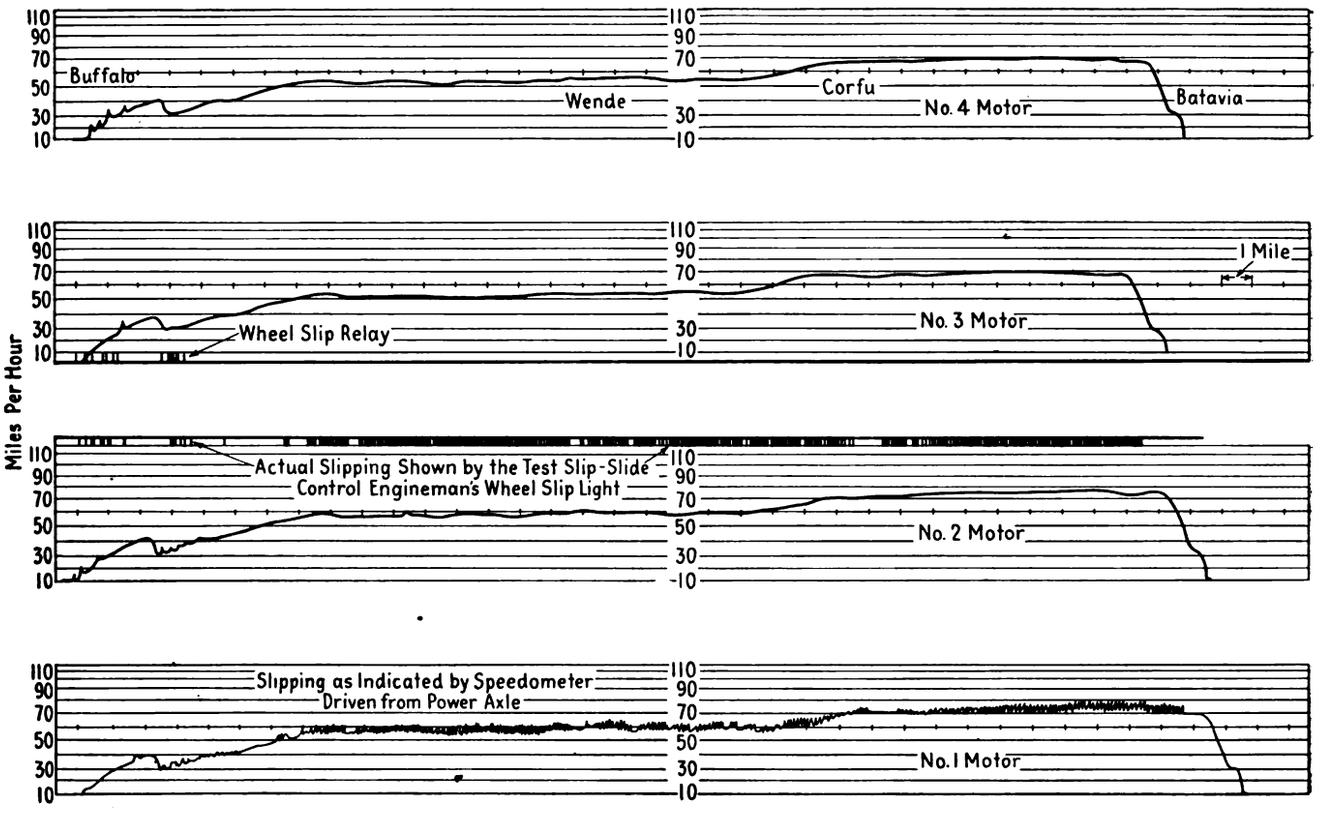
We had been investigating various types of slip relays for about four years when the A.A.R. committees directly interested in diesel locomotives were asked by the Interstate Commerce Commission to investigate devices which would sound an alarm if a wheel became locked. This condition had caused several accid nts. It was suggested that such wheel protective equipment should be independent of the circuits on the unit, so that wheel protection would be maintained at all times, even when the power plant was cut out.

In January, 1950, the A.A.R. Electrical Section Sub-Committee went on record that: "It was the opinion of the Committee that a device for protection of wheel slide should also incorporate protection for wheel slip with a view not only to simplifying equipment on the locomotive but that a device actuated by the action of the wheel itself would be more reliable than the present type of wheel slip protection or other devices that are not directly actuated by the rotation of the wheel."

Among the several devices suggested to the committees was a wheel control equipment which had been used for a number of years on passenger cars to protect wheels from sliding during braking. It appeared that an adaptation of this wheel control equipment could be made to afford the desired locked wheel alarm for all wheels and in addition provide an improved spin detection and an indication of wheel slide from braking. This equipment



The axle-driven wheel controller rotary switches as installed to protect each pair of wheels on Locomotive No. 4026



Example of excessive slippage corrected by the axle-driven wheel controller actuating locomotive wheel slip circuit in place of the regular wheel slip relays, but with circuits otherwise the same. This illustrates the tendency for slippage to occur under certain conditions as power is reapplied. (Train No. 52, Division—Syracuse, direction—Eastbound, trailing unit

is comparatively simple and consists of a commutator-type rotary switch driven from each axle, and a control with one relay per pair of wheels protected.

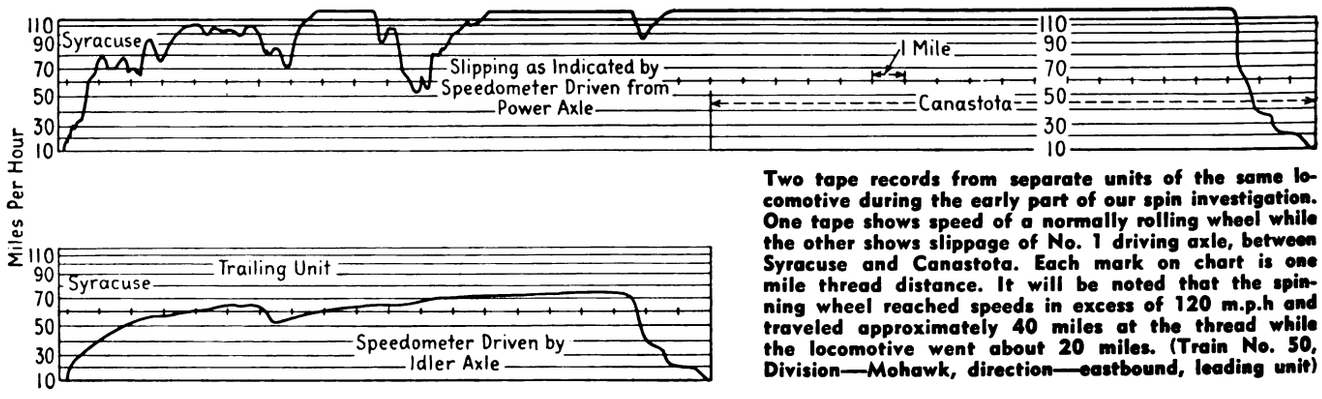
The New York Central agreed to apply that equipment to two diesel units for test report results to the A.A.R. committees. The Pennsylvania and Chicago and North Western have also applied similar equipment for test.

The test of the equipment was considered by the New York Central as a continuation of the original spin investigation. Application of this wheel protective device was made September, 1950, to one of the diesel units equipped with recording speedometers on each power axle. To date, ths wheel protective equipment has been in operation for approximately 298,047 miles on one unit and some 239,975 miles on the other. These units have received only routine service attention.

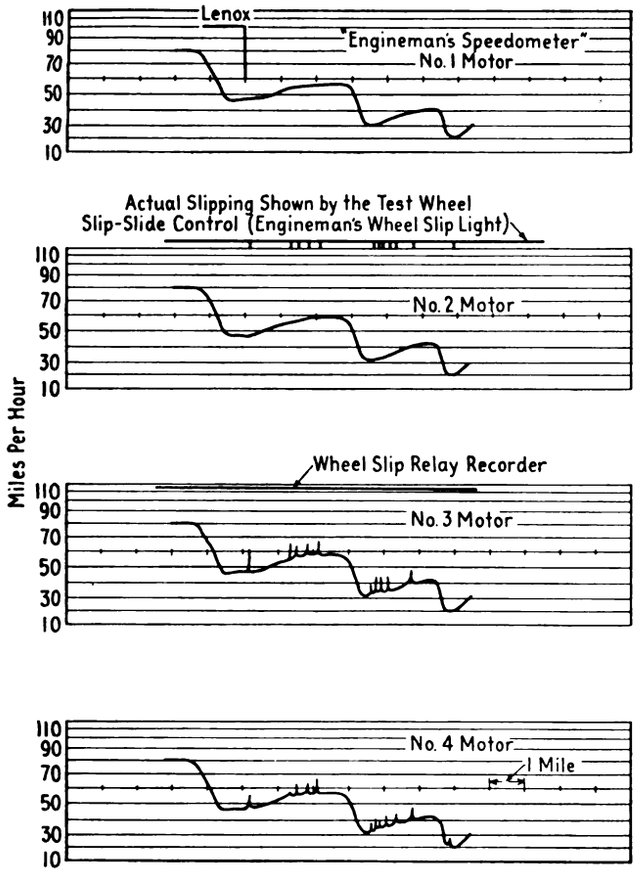
The test of this wheel protective device was made in two parts. First, the wheel control recorded its detection of slips or slides on the speedometer chart, but was not connected to actuate the locomotive slip control circuit. This proved the reliability of the device, as all slips exceeding 7 m.p.h. were detected.

During the six months trial period (September 16, 1950, to March 26, 1951) records were taken from 173 runs covering 1,017 divisions. In this service, the wheel controller on test detected all slips, totalling 3,919. The regular slip relay of the newest type detected 1,033, or 26 per cent of the total, leaving the locomotive without spin protection for 74 per cent of the slips which occurred. In addition, the wheel control device indicated a case of locked wheels caused by an armature band wire failure, and a case of sliding wheels due to braking.

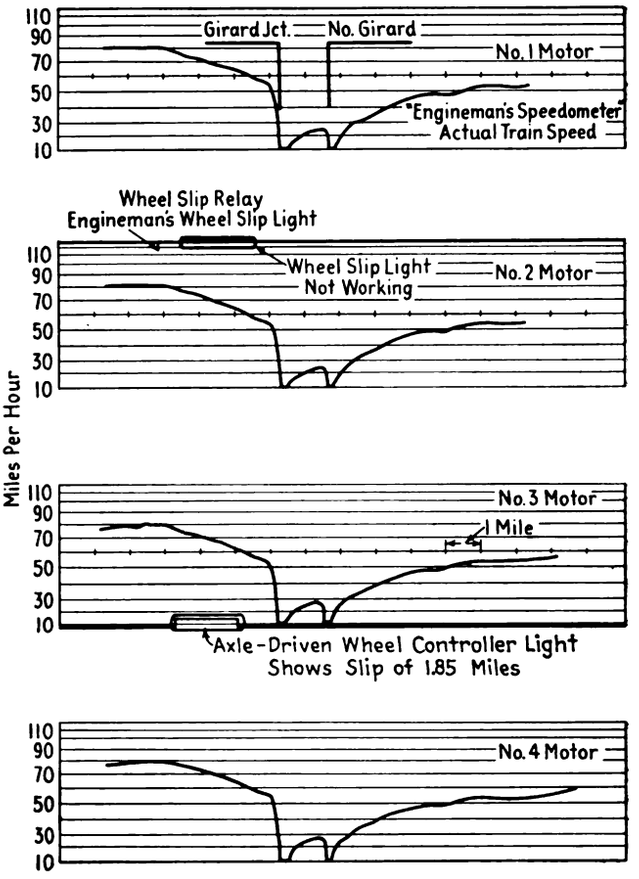
During the second part of the test, the wheel control device was connected to actuate the locomotive slip con-



Two tape records from separate units of the same locomotive during the early part of our spin investigation. One tape shows speed of a normally rolling wheel while the other shows slippage of No. 1 driving axle, between Syracuse and Canastota. Each mark on chart is one mile thread distance. It will be noted that the spinning wheel reached speeds in excess of 120 m.p.h and traveled approximately 40 miles at the thread while the locomotive went about 20 miles. (Train No. 50, Division—Mohawk, direction—eastbound, leading unit)



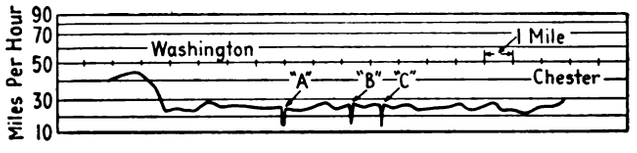
Example of slippage correction after change in locomotive circuit to reduce power momentarily at reapplication. Note that tendency for slippage to recur as power is reapplied has been eliminated. (Train No. 11, Division—Illinois-St. Louis-West, Direction—westbound, leading unit)



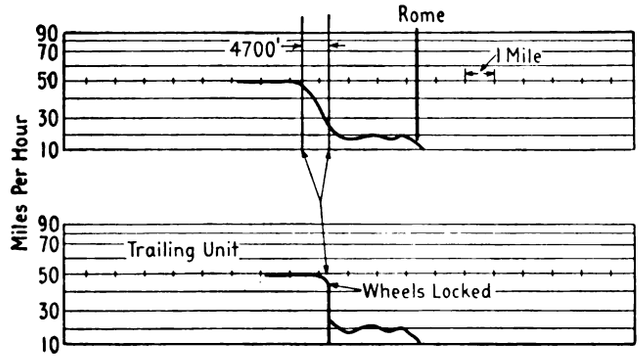
Sliding wheels due to broken traction motor armature band wire on No. 3 motor of trailing unit of test locomotive. Note that the axle-driven wheel controller indicated entire time wheel was locked, whereas regular wheel slip light gave no indication. (Train No. 1/26, Division—Erie, direction—eastbound, leading unit)

trol circuit. Also in this phase of the investigation, several variations of the slip control itself were tried to determine what improvements, if any could be made in the control of slips after the condition was positively detected by the wheel controller.

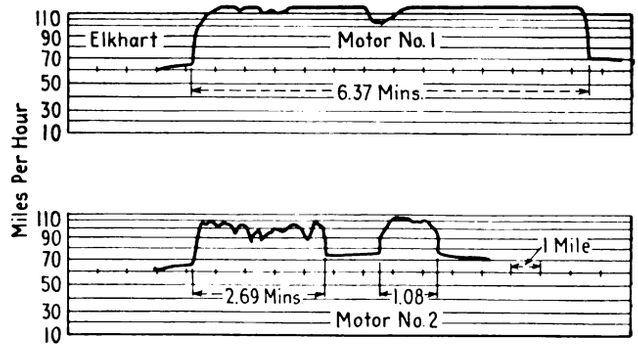
First, with the wheel control device operating in place of the regular wheel slip relay, but with the locomotive slip control circuit otherwise the same, the records indicated that all slips were controlled before the wheel spin exceeded rail speed by about 10 m.p.h. The duraction of a slip control was about two seconds. Usually, there was no operation of the wheel slip relay, which was discon-



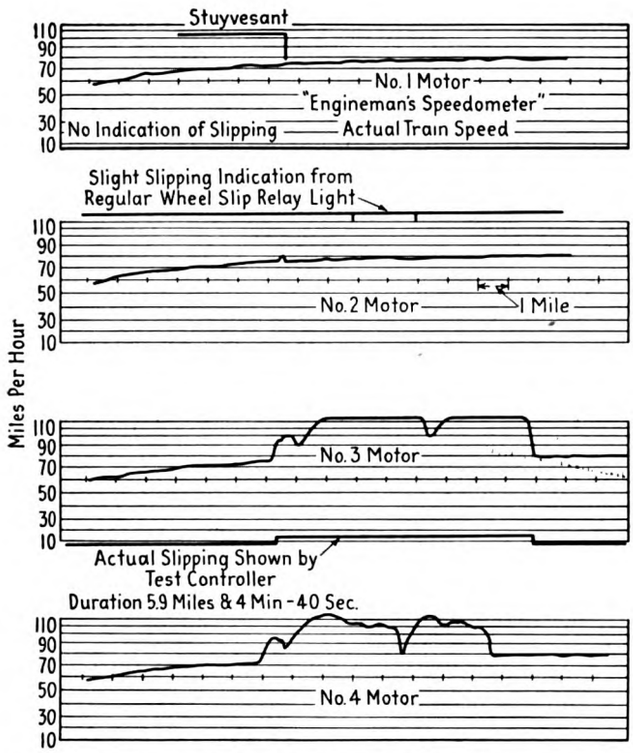
Three examples, A, B and C where motor-driven wheels slipped toward a locked condition due to excessive dynamic braking on a freight locomotive. Speedometer on a power-driven axle. (Train No. BA-2, Division—Albany, direction—eastbound, leading unit)



Example of wheels locked during braking possibly due to simultaneous use of dynamic and independent air brake on a freight locomotive. (Train No. BC-1, Division—Mohawk, direction—westbound, leading unit)



Another example, near Elkhart, Indiana, shows a wheel spinning for six and a half minutes at more than 120 m.p.h. for a tread distance of about 14 miles. (Train No. 68, Division—West Toledo, direction—eastbound, leading unit)



Tapes showing typical indication of slip by the axle-driven wheel control device which was not yet connected to the locomotive control circuit. It will be noted that the entire duration of the slip was recorded. Whereas only slight indication of condition was obtained from wheel slip relay. (Train No. 21, Division—Hudson, direction—westbound, leading unit)

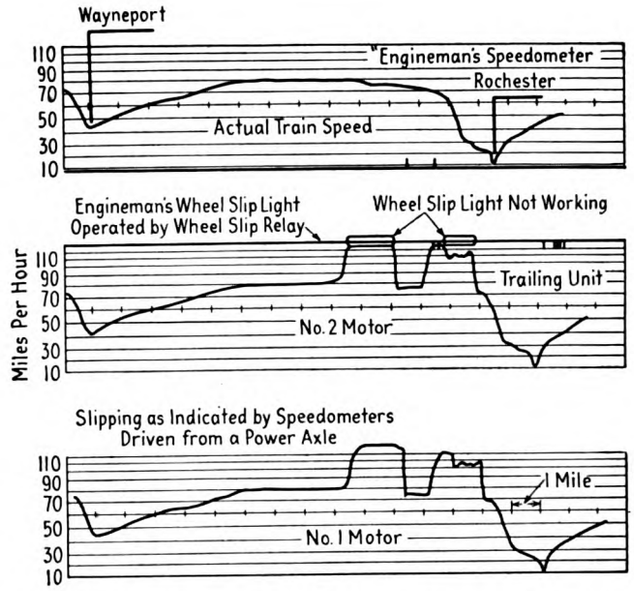
nected from the locomotive control circuit and attached to a pencil on the speedometer chart. The failure of the wheel slip relay to function was probably due, in many cases, to the prompt detection of the slip by the axle-driven device.

With this arrangement, however, the records showed the wheels often slipped again as the power was reapplied after a spin correction. On one occasion, with the locomotive operating between 60 and 70 m.p.h., it was necessary to control 296 slips in 28 miles. We believe this was due to the arrangement of the locomotive circuit, which permitted reapplication of full power too soon after a slip correction.

As another step in the investigation, means were applied to the locomotive circuits to momentarily reduce the power after a spin correction. This eliminated the tendency for recurrence of wheel slippage, and still permitted prompt reapplication of power. To date, this combination of axle-driven wheel slip detection and locomotive control circuit has given the best performance of any tried.

Summarizing the results of our wheel spin investigation, a few statements can be made:

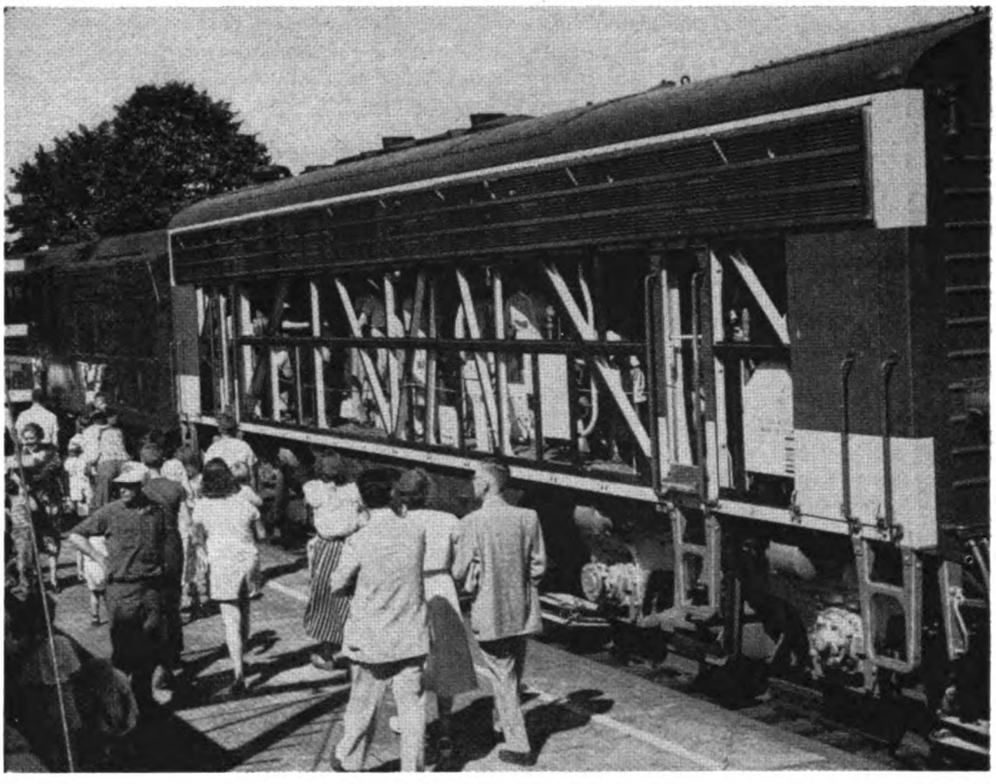
1. The existing wheel slip relay does not afford complete protection against locomotive spin.
2. Speeds obtained during slippage often exceed by as much as 50 per cent the limit recommended from the standpoint of stress on equipment.
3. Spinning of diesel wheels occurs on trailing units as frequently as on lead units, if not more often.
4. The engineman is often unaware of spin due to absence of slip light indication.
5. Wheel slippage occurred on all parts of the railroad. Weather influence on rail conditions is the controlling factor.
6. Axle-driven wheel protection has proved the most effective method to date for controlling wheel slippage.
7. Since the locomotive slip control circuits have been actuated from the axle-driven wheel control device, we have not experienced ground relay action due to spinning of wheels in approximately 104,000 miles. Prior to that period frequent ground relay action occurred.
8. It is believed that considerable saving in damage to locomotive equipment can be realized by providing the engineman with reliable indication of wheel behavior under all conditions.



These tapes show examples of simultaneous slippage of the two motor-driven wheels in the same truck. (Train No. 1, Division—Syracuse, direction—westbound, leading unit)



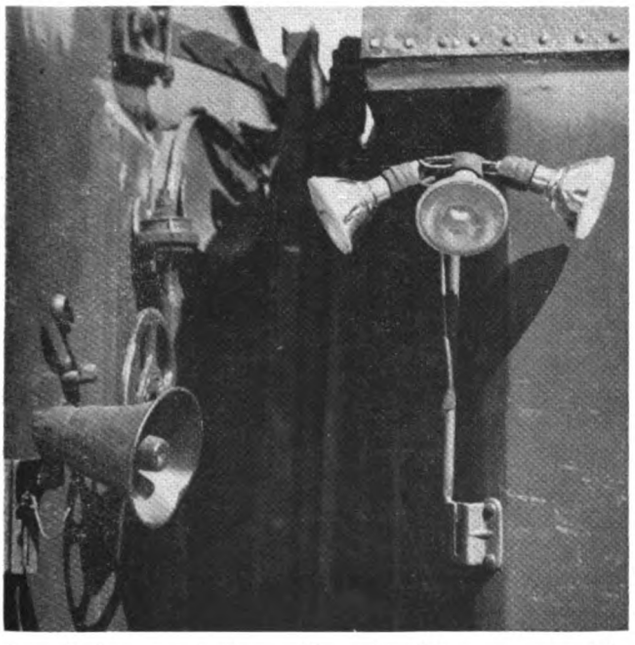
Application of a two-way radio, mounted on a fork-lift truck which permits communication between the driver and a central dispatcher. A recent Motorola development, it is designed for use on intra-plant vehichles to speed movement of materials. It can be operated from 6 or 12-volt d. c. or 117-volt a. c. power sources



Diesel unit with side panels removed showing visitors inside filing past slowly turning diesel engine, having sections removed to show operation of moving parts

Exhibit Train Power Supply

Two sources of power were used to supply the electrical requirements of the Erie Centennial Exhibition Train which recently completed a highly successful 54-day tour over the lines of the Erie, visiting over 100 cities. One of these was the a.c. generator on the E.M.D. diesel-electric locomotive unit used to haul the train between exhibit points. This generator is normally used to drive the blower fan motors at variable speeds proportional to the speed of the engine. To supply power to the exhibit train, the engine was run on the fourth throt'le notch with full field on the a.c. generator. Under these conditions, it supplies 38 kw., 3-phase a.c. power at 110 volts 63 cycles.



One of the sets of three reflector-flood lamps mounted in marker lamp brackets for night lighting. At the left is one of the loudspeakers used for music and announcements

Three dry-type transformers, connected delta-delta, mounted on the end of the locomotive were used to step this up to 3-phase, 220-volt, a.c. power for the train. Also 2,250 watts for outside lighting was taken directly from the generator at 110 volts.

The second source of power were two General Electric G M G 15A3 undercar diesel power plants loaned to the railroad for this purpose and mounted inside a baggage car. Cooling radiators were placed longitudinally on the floor of the car between sliding side doors which were open when the machines were in operation. These machines were capable of developing 50 kw. of 220-volt, 3-phase, 60 cycles, a.c. power. They were used to supply air conditioning and lighting on three cars equipped with axle-driven motor generator sets. The generator on each of these cars also supplied the lighting needs of a second car connected to it through the train line.

The G. E. undercar power plants also furnished 10 kw. of 110-volt power for inside and outside lighting through step-down, dry-type transformers. Power from the power

plants was distributed through the train by 220-volt, three-conductor portable cable, secured under the cars.

Outside lighting for exhibiting the train at night was provided by clusters of three reflector-flood lights, mounted in the marker lamp brackets on the ends of the cars. A number of 48-in., 40-watt fluorescent lamps of various colors were also used to light the trucks of a diesel B unit with removable side panels which were taken off during exhibits to open all of one side.

A coach used as a museum car had a large lighting load which was supplied from the 220-volt, three-phase cables through a dry-type transformer mounted on the car. Steam was supplied to the train by the oil-fired steam generator on the locomotive.

There were 19 units in the train. These were as follows:

1. A 1,500-hp. E.M.D. diesel-electric locomotive which hauled the train and supplied steam for air conditioning three cars and a part of the electric power.

2. A diesel-electric locomotive with removable side panels and an engine with cutaway sections so that slowly moving parts could be seen directly, and by the aid of mirrors. The engine was driven by a back-geared motor mounted in the space normally taken by the generator armature.

3. A diesel training car used by the railroad for the instruction of employees who operate and maintain diesel-electric locomotives.

4. Erie coach No. 1017 with steam-ejector air conditioning. This car was equipped with two P.A. loudspeakers to bring music to the car and permit the making of announcements.

5. A diner also having steam-ejector air conditioning. This car was also fitted wih loud speakers.

6. A Pullman with bedrooms, roomettes and open sections equipped with mechanical air-conditioning. Speakers were also included in this car.

7. A Pullman for the use of working crew. There were at times two of these cars depending upon the needs of the crews and the availability of outside facilities.

8. A diner for working crew. This car was equipped with propane gas for cooking.

9. The baggage car having the two diesel-electric power plants. This car also carried tools and spare parts, and booklets and pamphlets for distribution to visitors.

10. An army tank on a flat car.

11. A high and wide exhibit flat car.

12. A box car equipped to show use of lift trucks and methods of lading. It was equipped with electric lights for night showing.

13. A refrigerator car also electrically lighted for night showing.

14. A flat car on which was mounted a "Standard" locomotive built in 1851.

15. A baggage car of the vintage of 1851, mounted on a flat car; not lighted inside.

16. A centennial coach; also not lighted.

17. A flat car carrying an effigy of Daniel Webster in a rocking chair.

18. A museum car consisting of an electro-mechanical air conditioned coach with seats removed. The lighting load in this car was carried on the circuits used for outside lighting.

19. A radio-equipped caboose. The radio was used to communicate with the diesel locomotives, other trains and way stations, as needed in transit and for demonstration purposes during exhibitions.



Left: Rear end of the diesel locomotive used to haul the train showing dry-type transformers used to raise 110-volt a.c. generator power to 220 volts for driving motor-generator sets on cars. Right: Inside of baggage car. One of the undercar power plants. Radiators between doors. Second unit is beyond the doors. The control equipment is on the wall at the left.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

4 Running Maintenance of Commutators*

Only when the purpose of a commutator and its construction are understood, can it receive the kind of attention it must have

THE commutator is a vital part of every d.c. motor or generator. Hence, it deserves the very best of care. The fact that a commutator usually begs for maintenance by showing signs of trouble long before it actually fails is a big help to the maintainer. If you are able to recognize these signs and know what to do, you can often correct the trouble before it gets more serious. The more you know about how a commutator is made, and what it does, the better running maintenance you can give it.

* This is Part I of the 4th of a series of articles on maintenance of diesel-electrical equipment. This article is written by J. W. Teker and J. R. Schrecongost, both of the Motor Engineering Division, General Electric Company, Erie, Pa. Part II on the subject of commutator maintenance will appear in the December 1951 issue of *Railway Mechanical and Electrical Engineer*.

How a Commutator Is Constructed

As shown in Fig. 1, a commutator is made up of alternate copper and mica segments. The copper segments are often called "bars", and the mica segments are usually called "side mica". The side mica separates the bars electrically. The bars are wedge-shaped so that when assembled they form a cylinder. Each bar usually has a riser to form the connection with the armature coil. The bars are clamped between the shell and cap. Tightening the cap bolts moves the cap toward the shell. This causes the jaws to clamp the bars and pull them together to form a rigid cylinder. Mica cones prevent the shell and cap from short circuiting or grounding the bars. The side mica is undercut below the surface of the bars. This is done because mica wears more slowly than copper under the sliding action of the brushes. So, if it were not undercut, it would interfere with the brush contact on the commutator.

We may divide the work of the commutator into three parts. A study of Fig. 2 will serve to make this plain:

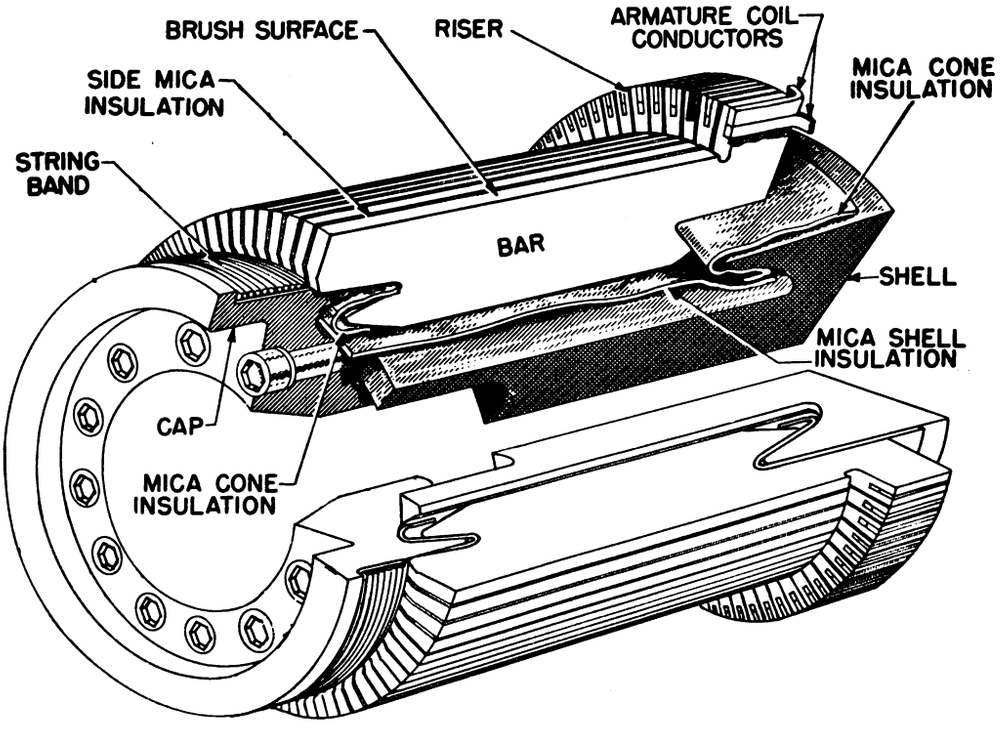


Fig. 1—Cutaway section of a commutator showing how it is put together

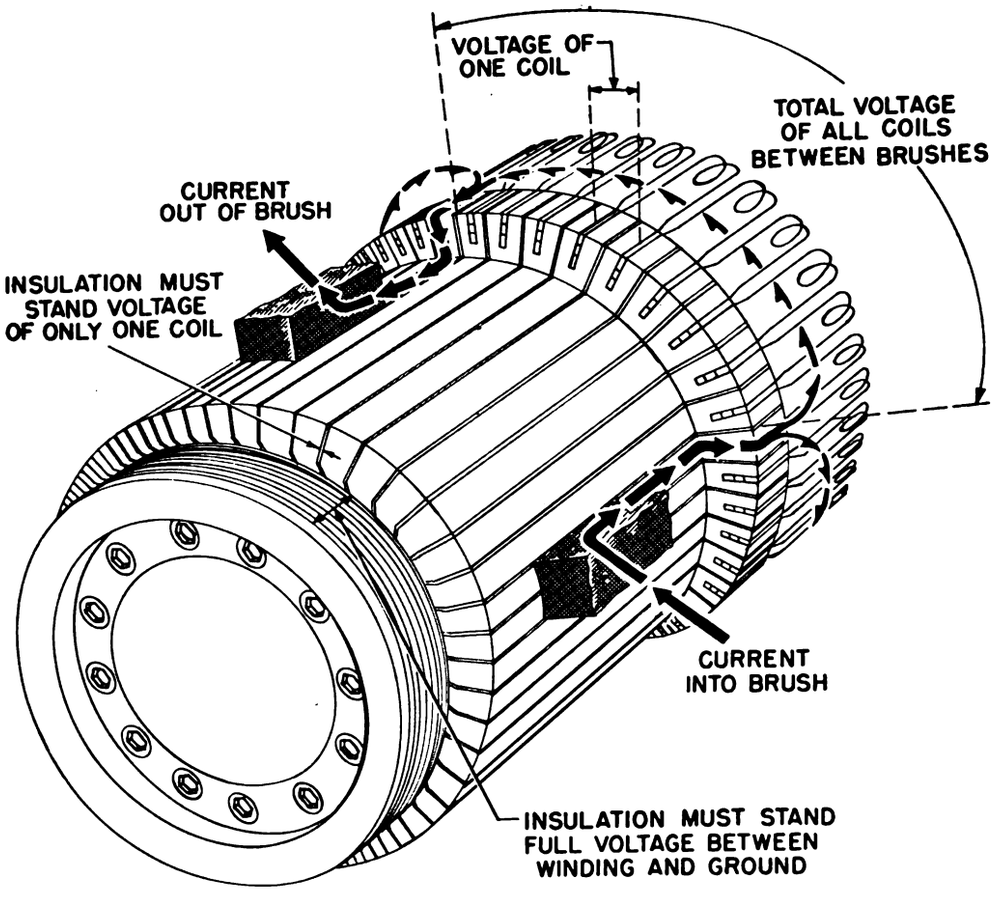


Fig. 2—The commutator must act as a reversing switch changing the alternating currents developed in the armature to the direct current in the exterior circuits

1. It provides the required sliding electric contact between the fixed brushes and the moving armature. Current enters the armature winding through a set of brushes. It then divides and follows two paths. When it reaches the next set of brushes, it leaves the armature. One such path is shown complete in Fig. 2.

2. The commutator acts as a reversing switch. As the armature coils pass the brushes, it switches them out of one circuit into another. This means that all the coils have current flowing through them in the right direction at all times.

3. The commutator also brings to the brush surface the voltage of each armature coil in the circuit. These voltages add up bar by bar between brushes. As a result, the total operating voltage of the machine appears at the brushes.

The All-Important Surface

No commutator can work as it should unless the brushes make good electric contact. This requires a smooth, cylindrical commutator surface that runs true with its center. When you realize that this surface may slide under the brushes as fast as 120 miles an hour, you see why it must be as smooth and true as possible.

Remember that a commutator is not one solid piece. It is made up of many sections of copper and mica clamped between steel parts. All these materials react differently to temperature changes. This means that forces are set up which tend to shift the parts. Also, the parts tend to shift during operation because of centrifugal force. Now you can see why it is almost impossible to maintain a perfect commutator surface. In spite of all that can be done, small variations are usually present. Brushes, being forced against the surface by spring pressure, will follow these variations, *if they are not too sudden.* Beyond that point you start to get into trouble.

It is the maintainer's job to spot a surface that is heading for trouble and correct it before failure results. A knowledge of various surface conditions and how they affect commutation will be helpful. Let us examine the more common ones.

Eccentricity. — Although a commutator surface is smooth, it may be running off center, as shown in Fig. 3A. It is then said to be eccentric. This is one of the most

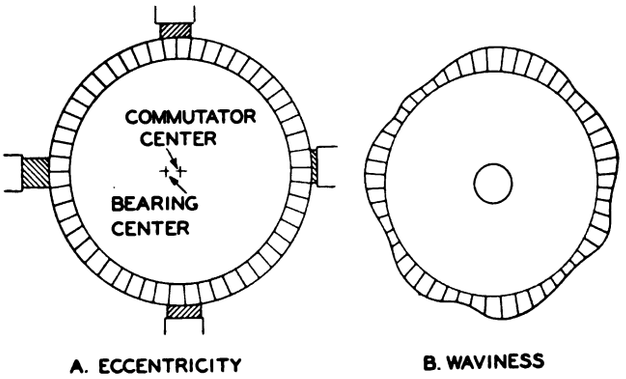


Fig. 3—Examples of commutator eccentricity and waviness, exaggerated for the purpose of illustration

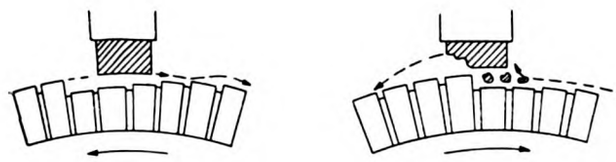


Fig. 4—Depressed bars may have different effects depending upon direction of rotation

common faults. It may result from the shaft being bent, the commutator being machined on bad shaft centers, or the bearings not running true. In single-bearing machines, such as generators, an offset coupling may be the cause.

This is usually the easiest of all surface variations for the brushes to follow. They simply rise and fall in the holders once with each revolution. However, as the speed goes up, this motion becomes faster. Finally, the brushes begin to break contact and gradually burn the commutator surface. As this continues the burning causes still further surface destruction.

Waviness. — The surface may develop waves, (see Fig. 3 B). To follow such a surface, the brushes must move in and out of the holders several times for each revolution. The motion is quicker for a given speed than that due to eccentricity. So, it is harder for the brushes to stay in contact with the surface. At high speeds, they bounce over the low spots like the tires of a car being driven rapidly over a rough road. Then we have sparking which burns the commutator surface and the brushes.

Surface Breaks. — Sometimes a sharp step or break occurs in a commutator surface, as shown in Fig. 4. It may be caused by a bump or blow to the commutator.

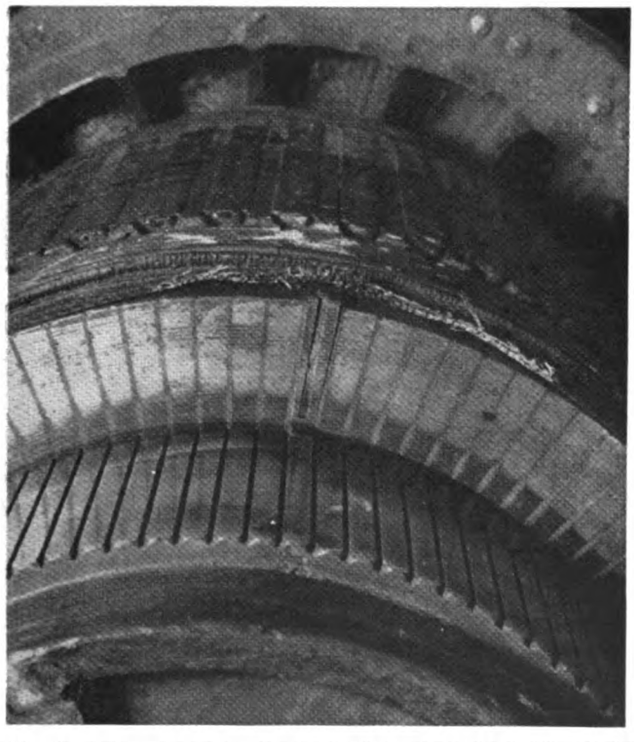


Fig. 6—Example of a soft commutator bar which has lifted at high speed

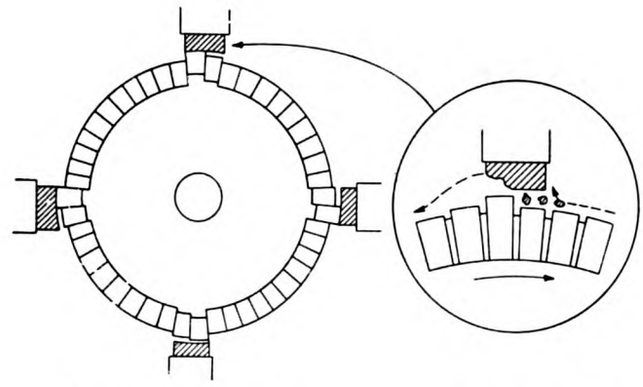


Fig. 5—Effect of high bars on brushes

The change in surface level may be very small, but it occurs almost instantly as the bad spot reaches the brush. For this reason, even a heavy spring load will not keep the brush in contact with the surface. If the commutator turns as shown in Fig 4A, the brushes will "ski-jump" from the high bar. Sometimes you can hear a distinct "click" as the brushes strike the commutator after their jump. If the rotation is as shown in Fig. 4B, the step strikes the brushes and "kicks" them away from the surface. At high speeds, this "kick" may be hard enough to shatter the brushes.

High Bars. — If a motor is held at standstill while the power is on, the commutator bars under the brushes will be overheated. These bars will expand and rise above the others. A commutator surface such as shown in Fig. 5 A is the result. The high bars kick the brushes and arcing and bouncing result, making the commutator surface even

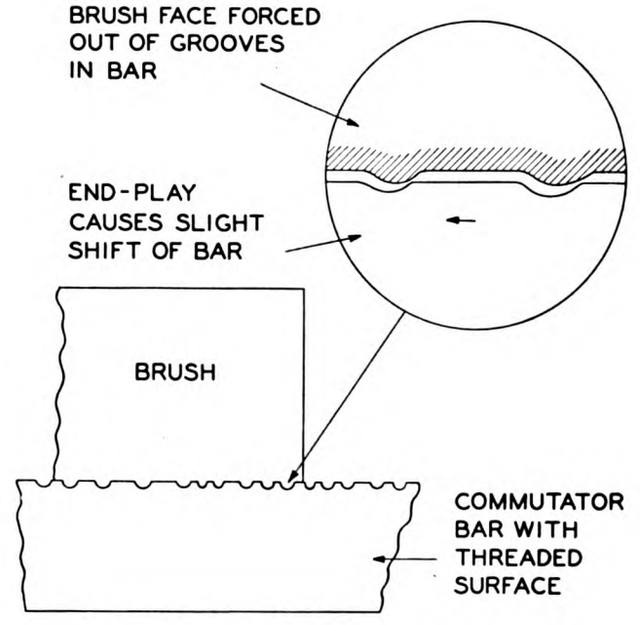


Fig. 7—Threading of the commutator as shown in the illustrations can cause the brushes to have reduced contact area when the commutator shifts due to end play

worse. If this condition is allowed to go uncorrected, the brushes will finally shatter and a flashover will result.

In severe cases, the temperature may get high enough to anneal the copper. The binder may even be burned out of the mica. This lessens the clamping action on the hot bars and they become loose. A commutator in this condition is very troublesome. The soft bars wear differently than the hard ones next to them. Because they are loose, they lift at high speed, as shown in Fig. 6.

If you suspect annealed bars, check them by comparing their hardness with that of adjacent bars. This can be done by the use of a sceleroscope or by some equivalent means. Often annealed bars can be spotted by their discoloration, especially at the ends where the brushes do not slide.

A quick check for loose bars can be made by tapping each one gently with a light hammer. At the same time, feel for vibration between bars with the finger tips.

Poor Surface.—The appearance of a commutator surface will vary. This may be the result of temperature, atmosphere, and the grade of brushes used. These all affect the thin film formed on the commutator surface during operation. A regular pattern of dark and light colored bars may develop. As long as the surface is smooth and polished, such changes in color are no cause for worry. When the surface becomes dull, raw and roughened by burning or abrasive action, trouble is on the way. Under some conditions, copper is pulled over the edges of the bars. This decreases the actual distance between bars. An arc formed at a brush is then more easily carried over to the adjacent set of brushes, resulting in a flashover. This is the commutator's warning that something is wrong. The wise thing is to find the cause of the trouble, and do all you can to correct it.

Looseness.—Glancing back, Fig. 1 shows how a commutator is held together by the clamping action of the shell and cone. Failure of the clamping action may be caused by loose or broken commutator bolts. It pays to check these bolts regularly. If even one fails or works loose, it can cause a serious accident. Overheating of the commutator is another source of looseness. This may be caused by lack of ventilating air, overload on the machine, or sparking. The heat may soften the mica binder. Then the flakes of mica shift away from the pressure areas, and the bars loosen.

Threading.—This is the most common surface defect running around the commutator, crosswise to the bars. It shows as small, thin grooves cut into the surface by abrasive action. The brush face wears to fit into these grooves. When the commutator shifts, due to end play, the brush is lifted out of these grooves, as shown in Fig. 7. The contact between the brush and the commutator surface is disturbed and poor operation may result.

Any of these commutator defects acts like a break in a highway pavement. At first, it is hardly noticeable, but if it is not cared for, it becomes worse and worse, until finally the road must be closed. So, a commutator does not fail suddenly. It gives warning in time for the trouble to be corrected. Bouncing, or shattered brushes, or bad overloads, will cause arcing at the contact surface. When these arcs become severe enough, they will bridge the insulation between bars. This permits the power to spill over between brushes in a burst of flame hot enough to melt metal. This is the commutator's final protest against abuse. Evidence that a machine has flashed over is found in copper splatterings on the surface and ends of the commutator bars. Often these are also found on the brush holders, the surrounding insulation, and nearby parts of the steel frame.

CONSULTING DEPARTMENT

Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—Why does a battery have to be kept clean?

A.—To prevent external circuits across the top of the battery and retard corrosion.

Q.—How often should a battery be washed?

A.—A battery should be washed every month at the time of inspection of the entire diesel.

Q.—Should battery be washed with soda if a cover is cracked or cell leaks?

A.—Cracked or leaking cells should be repaired before the battery is cleaned.

Q.—Can battery be cleaned with high pressure air?

A.—Yes. Provided the battery has been washed with a neutralizing agent before. It is recommended that the tops of the batteries be washed with a solution of soda and water and then blown dry with a steam or air hose. Either hot water or steam can be used to clean a battery.

Q.—How often should a battery compartment be cleaned and painted?

A.—It is recommended that the battery compartment be cleaned and painted at the time of the annual inspection of the locomotive.

Q.—What kind of grease on termilals won't wash off?

A.—No-Korode.

Q.—What happens when there is a loose connection?

A.—A high resistance contact results, and if an arc develops, it is possible for the entire terminal to burn off.

Q.—How often should the battery compartments be checked for tightness?

A.—At least every thirty days.

Q.—What causes corrosion on the positive terminals and connectors?

A.—Corrosion of the positive terminals and connectors is more noticeable than the negatives, in that the positive terminal becomes peroxidized through the action of the charge to the battery.

Q.—What causes burning or melting at terminal connections?

A.—A loose connection,—poor contact.

Q.—How can you detect a shorted cell?

A.—Low specific gravity and low voltage is an indication of a shorted cell.

Q.—Is it always necessary to take voltage readings when taking gravity readings?

A.—It is not always necessary, but it is a good idea to give you a complete picture of the condition of the battery. If all cells have equal specific gravity readings, it is safe to assume that the voltage will read likewise.

Q.—Is it necessary to take the temperature of each cell?

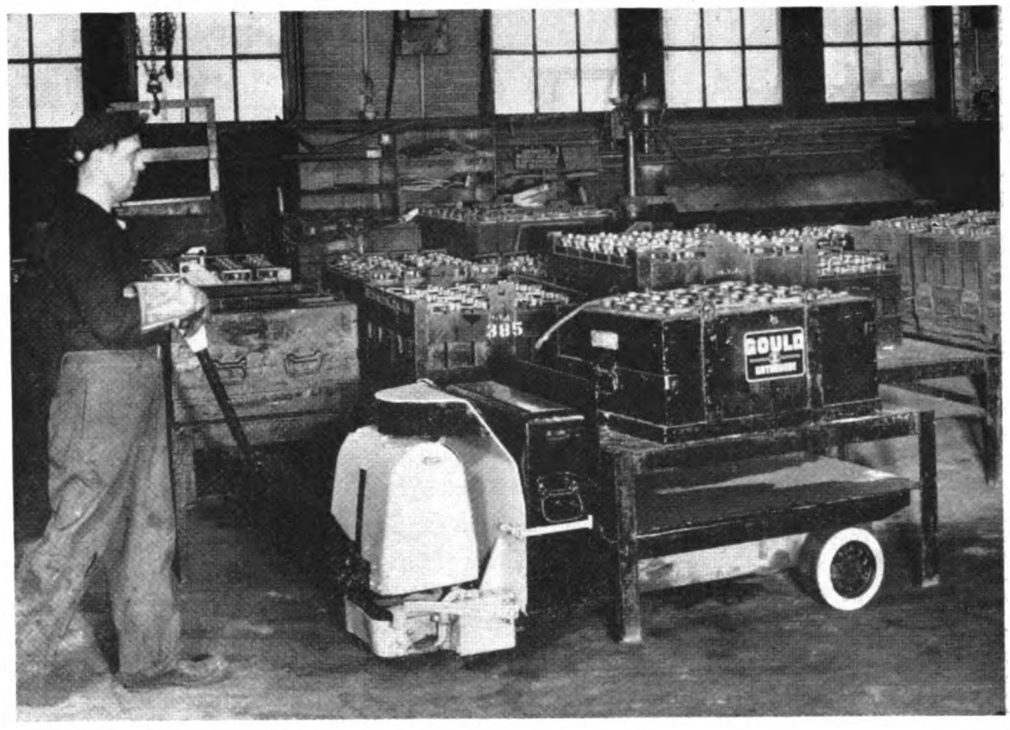
A.—It is recommended that the temperature of every fifth cell be taken.

Q.—In equalizing a battery, how can you tell when battery is completely charged?

A.—When the specific gravity of a battery stops rising and remains constant for three one-hour readings, it is safe to assume that the battery is fully charged.

Q.—What strength acid should be added?

A.—Normally, acid should never be added to a battery unless with the advice of a competent battery man.



When batteries leave the shop they are clean and connections are tight. They must be kept that way to insure their giving the service that is expected of them

Q.—Why is it that gravity reads higher (after equalizing) when it has been in service for a month or so?

A.—If the battery reads higher, for instance, (after equalizing) when it has been in service for a month or so, it is an indication that the battery may not have been in a fully charged condition when the first reading was taken.

Q.—Does battery temperature have anything to do with adding acid? The question usually is, should equalizing and charging be stopped at any definite temperature?

A.—Equalizing and charging of batteries should be stopped when the temperature rises to 115 deg. F. and the battery allowed to cool before continuing the charge. The temperature of the battery doesn't have anything to do with adding of acid, except the proper temperature correction of the gravity should be made as indicated previously.

Q.—If no cells are leaking, why should battery be equalized?

A.—A storage battery being charged through voltage regulations such as diesel battery, may never need to be equalized.

Q.—Is it safe practice to cut cells out?

A.—Sometimes it is better to cut cells out of circuit if it is impossible to repair the cells at once. This is an emergency measure only. Whenever cells are cut out of the circuit, the voltage regulation must be adjusted for this reduction in cells.

K. A. VAUGHAN
Gould Storage Battery Corporation

Authenticated News Photos



British double-deck electric train, shown on a run between London and Dartford, England, consists of four cars, and has a seating capacity of 552 persons

EDITORIALS

What Makes A Successful Convention

The meetings of the five Coordinated Mechanical Associations and the A.A.R. Electrical Sections, held at Chicago September 17 to 19 are now history and it is worth while to record the fact that this year's convention was a success from the standpoint of both the railroad and the supply industry. Many factors made this possible. Three of these are worthy of emphasis. First is the character of the organizations themselves, determined by their purpose, the soundness of their organization plan and by the effectiveness with which their programs measure up to their objectives. Then there is the matter of the geographical location and the general character of the meeting place. A third factor is the associated exhibit of appliances and materials when one is held, as it was at the Hotel Sherman this year.

There can be little doubt that the associations referred to here, since they have been working together under their own coordinating committee with the guidance and support of the A.A.R. Mechanical Division, have developed characters which contribute definitely to their growing influence. The present numerical strength of the various organizations varies but there is little evidence that any of them is losing ground, even the Master Boiler Makers', which is resolutely facing the toughest problem of them all because of the declining importance of the steam locomotive. Several are steadily increasing their membership. Their programs are constructively dealing with problems which are currently acute and the organizations are being effectively operated.

Over the years there have been numerous ideas as to the character of meeting places desirable for associations of railway men. Some of the smaller organizations formerly liked to get around, holding each annual meeting in a different city. This policy favored various sections of the country in successive years and, for small, cohesive organizations, worked reasonably well. Another idea long in vogue is to meet at a resort where the vacation atmosphere is dominant, particularly when an exhibit is involved. This has lost much of its popularity with the railroads largely because of the excessively elaborate entertaining which it inspired. Now Chicago has become well established as a central location where meetings, with or without exhibits, can be held in an atmosphere congenial to serious business and with little time allowed for extraneous activity. This tends to keep entertaining within reasonable bounds. From casual observation of the sessions it seems evident that entertainment is not interferring with the attendance.

That these characteristics of Chicago meetings do not militate against their success seems to be definitely proved by the way in which the attendance at the full Mechanical conventions has been growing during the past few years. Registration at this year's Coordinated Association meetings, including that of the electrical Sections, amounted to over 4,500, of which 2,500 were members or railroad guests of the railroad associations, 1,320 were railway supply men and the remainder ladies. Allowing for an overlap of between 10 and 15 per cent of the railroad-association registration for the supply men who also registered as members of these organizations, the railroad attendance at these meetings this year was record-breaking.

An outstanding exhibit, such as that organized by the Allied Railway Supply Association at the Hotel Sherman this year, will be a stimulant to the attendance of railway men at future conventions; the character and extent of the exhibit, in turn, was undoubtedly influenced by the excellence of the attendance at previous annual meetings of these associations.

The 110 exhibitors filled all the space available. Comments from exhibitors indicate that it generally commanded the interest of the railroad men. Those who attend these meetings are the ones who are generally directly concerned with the operation and maintenance of a large proportion of the devices exhibited, a fact which goes far to account for the mutual satisfaction of both parties with these meetings and exhibits.

Location is a matter of equal importance to the railroad associations and to the exhibitors. The growing success of these fall mechanical association meetings and exhibits over the past several years suggests that a central location, dominated by an atmosphere of business, is right for the associations and the exhibitors alike.

How Can Diesel Clubs Be Most Useful

Diesel clubs have increased in numbers and have grown in membership to the point where they can be of substantial value to mechanical departments in improving the operation of diesel power and reducing the costs. Their importance has grown to the extent that their overall policies both individually and collectively can have a direct bearing on the education of mechanical-department employees. What then should be the function of diesel clubs best to serve the railroad industry and its employees?

Should the general aim of a diesel club be to disseminate knowledge to its members so that all will have a passable ability to maintain locomotives; or, should the primary purpose be to distribute more advanced knowledge to those hoping to approach the expert level? Should the programs in the main be devoted to schoolroom education on how the equipment is put together and why it operates as it does; or should the meetings be primarily forums for discussion of problems as they arise, assuming that basic principles and design are well understood? Again, on the degree of advancement of the subject matter, should equipment descriptions be devoted to the fundamentals for those who are unable to understand these fundamentals from reading the manuals; or should the meetings be devoted to extension of the information contained in the instruction manuals, telling not only what the equipment is like and how it operates, but go into the "whys" of the design and the troubles that occur as well?

Can diesel clubs compromise their programs to widely divergent groups so that subjects at meetings will neither be over the heads of the beginner nor too elementary for the experienced? Or would an attempt at such a compromise lead to all members losing interest, the beginners because they were hopelessly confused and the more experienced because the program seemed to them like a kindergarten?

What about division between crafts of the maintenance forces, and between those concerned with maintenance and with other aspects such as operation? Should there be separate meetings or clubs for major divisions? It is pretty well established that the machinist and the electrician should know something of each other's problems and difficulties because of the close relationship between the mechanical and the electrical parts of the locomotive. But just how far should this go? It must necessarily be accomplished at the expense of a man learning less about his own craft. There are workers whose job requires little if any knowledge of other types of work; a sheet-metal worker handling steam generators has little reason to know anything about air brakes, for example.

It is likewise important to decide whether the railroads should first decide what type of personnel training they want and have the diesel clubs help provide this training or whether the diesel clubs should go on educating the railroad employees in whatever way they think best and then have the railroads adapt their organizations to the type of training that the diesel clubs have helped to give them. The railroads should decide whether they want a diesel maintenance organization in which everybody knows a little and can stumble through most any job that comes up, given sufficient time to work it out, or whether it would be better to have a few experts on each of the major components of the locomotives who would direct the mechanics as to what to do to a part that is giving trouble, e.g., clean it, change it, repair it, etc.

These are matters which should not be decided without having been given serious consideration. They may involve matters of railroad policy but an informal discussion may clear the points.

Electricians For the Diesel Shop

Six years ago, a diesel shop foreman of a southern road said, "The time is not so far distant when we will need as many electricians in the diesel shops as we will mechanics." It would scarcely seem that this would ever quite come to pass, but the need for more electrically trained men has become a problem for many roads.

Only a few days ago, the shop superintendent of an eastern road asked, "Do other roads have as much trouble as we do finding electricians?" Had shop superintendents of the "other roads" heard that question, they would have answered that not only do they have trouble finding good electricians, but in the face of competition from defense industries, they have difficulty in keeping those they have.

One of the difficulties arises from the fact that a "good" diesel electrician really should be a good mechanic before he takes on the responsibility for things electrical. It is no longer easy to distinguish the difference between electrical and mechanical work in the diesel shop. Many mechanical devises are in part electrical, and the maintenance of many electrical devices (commutators being one example), requires the best of mechanical precision.

Many men with a background of railroad experience—men who feel their business is railroading—have found their jobs in jeopardy or their future uncertain because of the decline of the steam locomotive. It is from among these men that those to fill most of the new jobs must be found.

It is in recognition of this situation that *Railway Mechanical and Electrical Engineer* is running the series of articles called "Diesel-Electrics—How to Keep 'Em Rolling." The articles began in the July, 1951, issue, and will continue for at least a year and a half. They deal specifically with electrical equipment used on diesel locomotives. They are written so that an electrical background is not necessary for their understanding. Although they deal with technical subjects, they make interesting reading. Each article is complete in itself, but for those who were not subscribers in July, reprints of the first articles will be made available. We believe the uninformed reader will find that many electrical mysteries are pretty simple things, and that those with long experience will discover things they have forgotten. All will learn specific requirements of diesel equipment.

NEW DEVICES

Dynamic Grill for Diesel Locomotive

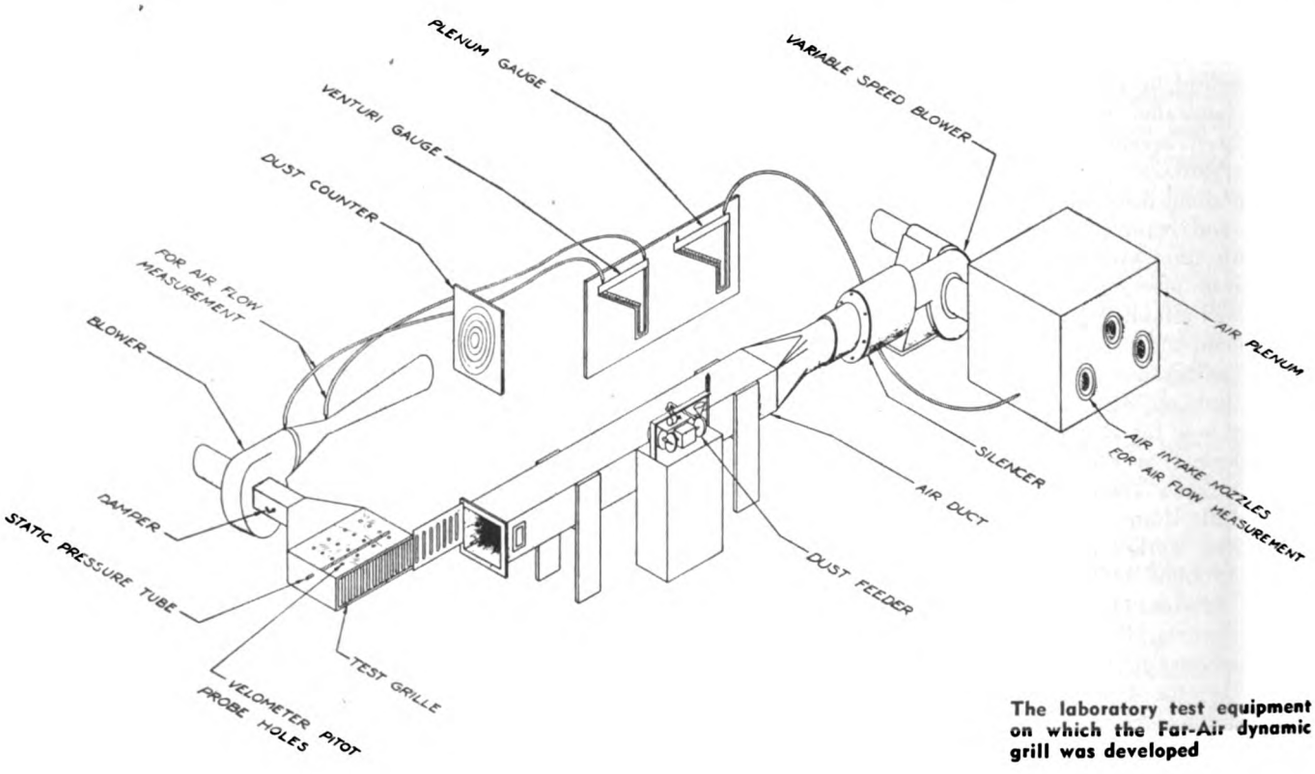
During heavy snowstorms snow has come through the engine-room air filters of diesel locomotives and has shorted electrical apparatus to such extent as to cause unit failures. This is not surprising, for it cannot be expected that filters 2 in. thick can catch and hold the load of snow accumulating during a 4- to 6-in. snowfall. Such rapid loading on the face of the filter would clog it and then the demand of the engine for air would be so great that snow would actually be pulled through the filters.

In 1947 a railroad presented to the Farr Company. Los Angeles, Cal., the problem of how to keep snow out of diesel locomotive engine rooms. It was at first felt that some kind of installation could be made inside the filters to seal off and prevent snow from entering the engine room. However, such an installation, under certain conditions, would shut off the air supply to the engine and the lack of cooling air could also interfere with traction-motor operation.

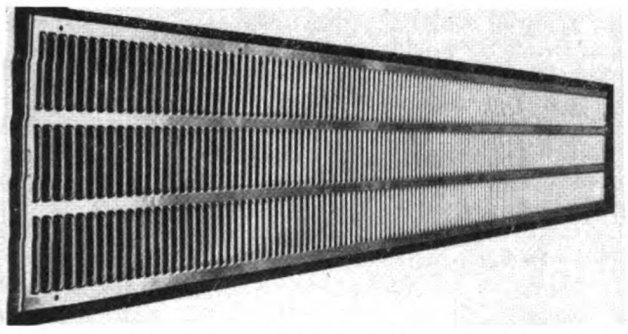
A laboratory project was next scheduled to develop some kind of baffling device which could be placed on the outside and which would prevent snow from reaching the filters. It was recognized that any such baffling device, if placed on the outside of locomotives, would need to function in both directions of locomotives travel and that restriction to air flow be low enough not to interfere with engine performance, radiator performance, or dynamic grid performance. It was also felt to be highly desirable that such a piece of equipment, which would be mounted on the outside of the locomotive, should have some decorative appeal.

With these requirements in mind, laboratory testing was carried on with the purpose of developing some device which would keep snow out of diesel locomotives. In laboratory procedure, with the grill model fixed and stationary, air was blown through a duct and on out over the intake face of the model grill and air was drawn through the model at right angles to the direction of the air stream across the face of the grill at the velocity required in road operation. The air velocity past the model intake face was variable from zero to approximately 125 m.p.h. The test setup is shown in one of the illustrations.

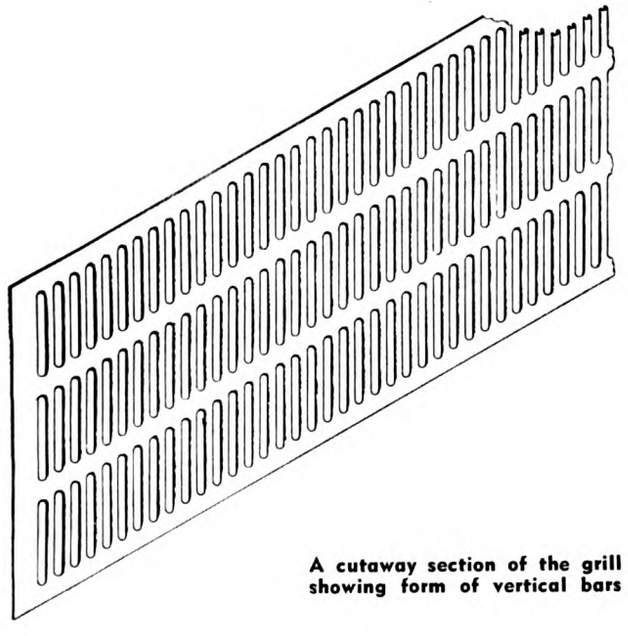
Nothing closely resembling snow was available for testing material. Because of its light density corn-meal dust was used for this purpose. The —40 +50 mesh-sieve fraction was the size range used for testing. Railroad personnel familiar with the snow nuisance said that, in size and gross appearance, it closely resembled snow when wind-driven at low temperatures. It was felt that this kind of snow would be the most difficult to keep



The laboratory test equipment on which the Far-Air dynamic grill was developed



A section of the Far-Air dynamic grill approximately 12 ft. long by 2 ft. wide



A cutaway section of the grill showing form of vertical bars

from entering the locomotive body. The corn-meal dust was introduced with a dust feeder by means of compressed air and at a uniform rate.

Grill performance was evaluated by comparison with existing locomotive air intake design and also with an open space of the same size having no protective covering. Quantitative particle baffling efficiency was determined by blowing all the air which was drawn through the open space or model grill through a venturi section sized to impinge all the entrained particles on a flat adhesive-coated target with concentric circles for easy counting. Efficiencies were determined by the number of particles found to have been drawn through the different test grills as compared with the number drawn through the open space of the same area.

Some 50 to 75 different models were tested before settling on a single design. The selected design showed that approximately 95 per cent of the corn-meal dust was baffled off, as compared with the open space, when air velocity past the face of the model grill was in excess of 2,000 f.p.m. Incidentally, these test results have been confirmed by another laboratory setup.

A cutaway section of the grill is illustrated. It is installed so that the half-round bars are even with the outside surface of the side walls of the locomotive and the bars are in vertical alinement.

The operation of the grill is simple. The air flowing past the grill, because of the speed of the locomotive, is forced to change direction to enter the grill. The net velocity through the grill openings in front of the filters at full air requirements is approximately 1,000 f.p.m. Particles such as snow, which are in the outside air stream which is flowing at right angles to the grill face, are forced to make a 90-deg. bend in order to enter the grill. The mass of these particles is such that, when the train has any speed at all, the particles do not turn as sharply as the air stream with the result that they impinge on the round surfaces of the grill bars and are baffled out again into the outside air stream. This effect is similar to the operation principle of a dynamic separator, hence the name "Dynamic Grille."

The grill has no functional value while the locomotive is standing or running at very low speeds. It was found, however, that the troubles caused by snow were encountered usually when the locomotive was traveling on the road. Likewise, the grill is non-functional, dynamically, when the train is traveling through a side wind.

After the laboratory testing, the next step was to install a full-scale grill on a locomotive for testing on the road. This was done in 1948 and extensive field testing was begun. The first quantitative road tests made were in the summer. With these tests efficiency was evaluated on the basis of the amount of dirt the grill kept from reaching the air filters. The grill was actually applied to a booster unit in a four-unit 6,000-hp. locomotive.

Quantitative tests were made on this locomotive while in passenger service between Chicago and Los Angeles. Determination of effective grill efficiency was based on comparison of the weight gain of the filter in the booster unit behind the dynamic grill with the weight gain of the filter behind the standard protection for diesel locomotives on the adjoining booster unit. Several tests were made and they indicated that the dynamic grill baffled off somewhere between 50 per cent to 75 per cent of the dirt encountered in operation. The train operated in both directions so that each unit operated half the time in the No. 2 position and half the time in the No. 3 position. The variance in efficiency results was attributed to the probability that variable dust conditions were encountered during the test periods. The heavier the dust concentration and the larger the particle size, the more efficient the grill would be.

The objective of this project was specifically to prevent snow from getting into diesel locomotives. However, after developing the grill, it was found that it also reduced the amount of dirt which the filters had to handle, which consequently reduced the amount of dirt which actually entered the engine room. This dirt baffling feature of the grill is highly beneficial, especially in sandstorms or localities where high concentrations of dust, which would ordinarily swamp the filters and temporarily lower their efficiency, are encountered. Since the grill is more efficient on large particles due to their greater mass, it does an excellent job of keeping large particles, such as cinders, from even reaching the filters. The grill is not too efficient on very fine particles due to the fact that at velocities comparable to speeds that are normal to locomotive operation, the inertia of the very small particles is not great enough to cause them to be separated from the air stream entering the grill.

When a snowstorm was encountered, the booster unit which had the dynamic grill was in the No. 3 position. The outside temperature was in the range of zero to 10 deg. F. and the train was traveling between 40 and 55 m.p.h. In this test it was observed that in the No. 2 unit,

considerable snow was on the car-body filters and snow actually entered the locomotive body. In the No. 3 unit, which was equipped with the dynamic grill, there was no snow whatever in the car body, and only a small amount was showing on the car-body filters. In the trailing unit No. 4, snow was packed in the car-body filters and was coming through them in amount large enough to pack in the engine air filters and to cover the floor of the engine room. During this test run, when a filter was removed from the panel, scarcely any snow came through the grill and it was observed that there appeared to be a heavy layer of snow in the air outside staying about 2 to 3 in. away from the face of the grill. This denser layer of snow, no doubt, consisted of snow particles which had been baffled off by impingement on the curved surfaces.

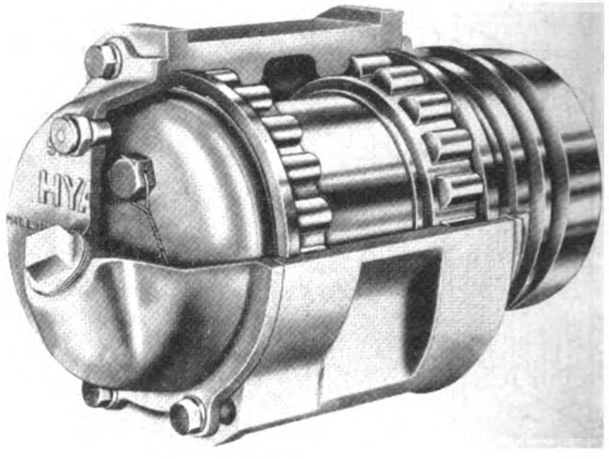
Special checks were made with the locomotive both stationary and in operation to prove that the grill did not starve the radiators or dynamic grids of air flow. If the grill did starve either one of these important air requirements it would have been impracticable in field operation. Strangely enough, laboratory tests indicated that the higher the train speed, the lower the resistance to air flow through the grill. The resistance to air flow through the grill at required entering velocities is in the order of 0.15 in. of water.

The grill does not assure protection against snow and dirt under certain conditions, but is believed to operate efficiently during enough of the locomotive operative time to make it worth while to apply to diesel locomotives, particularly where ornate grills of no functional value are put on merely for decorative trim, and especially since the dynamic grill can be applied at approximately the same cost to the railroads.

A considerable number of the Far-Air Dynamic Grilles are in operation on diesel locomotives with reports of excellent performance.

Hyatt Roller Bearings For Freight-Cars

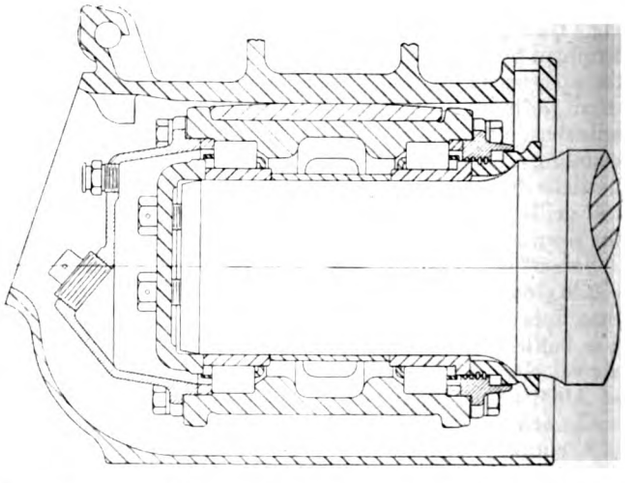
A new line of roller-bearing journal boxes for freight cars has been developed by the Hyatt Bearings Division of General Motors Corporation, Harrison, N. J., which are designed to fit conventional freight-car trucks with both the integral box type and pedestal type side frames. They can be installed to replace existing plain-bearing equipment with minimum alterations to the truck side frames.



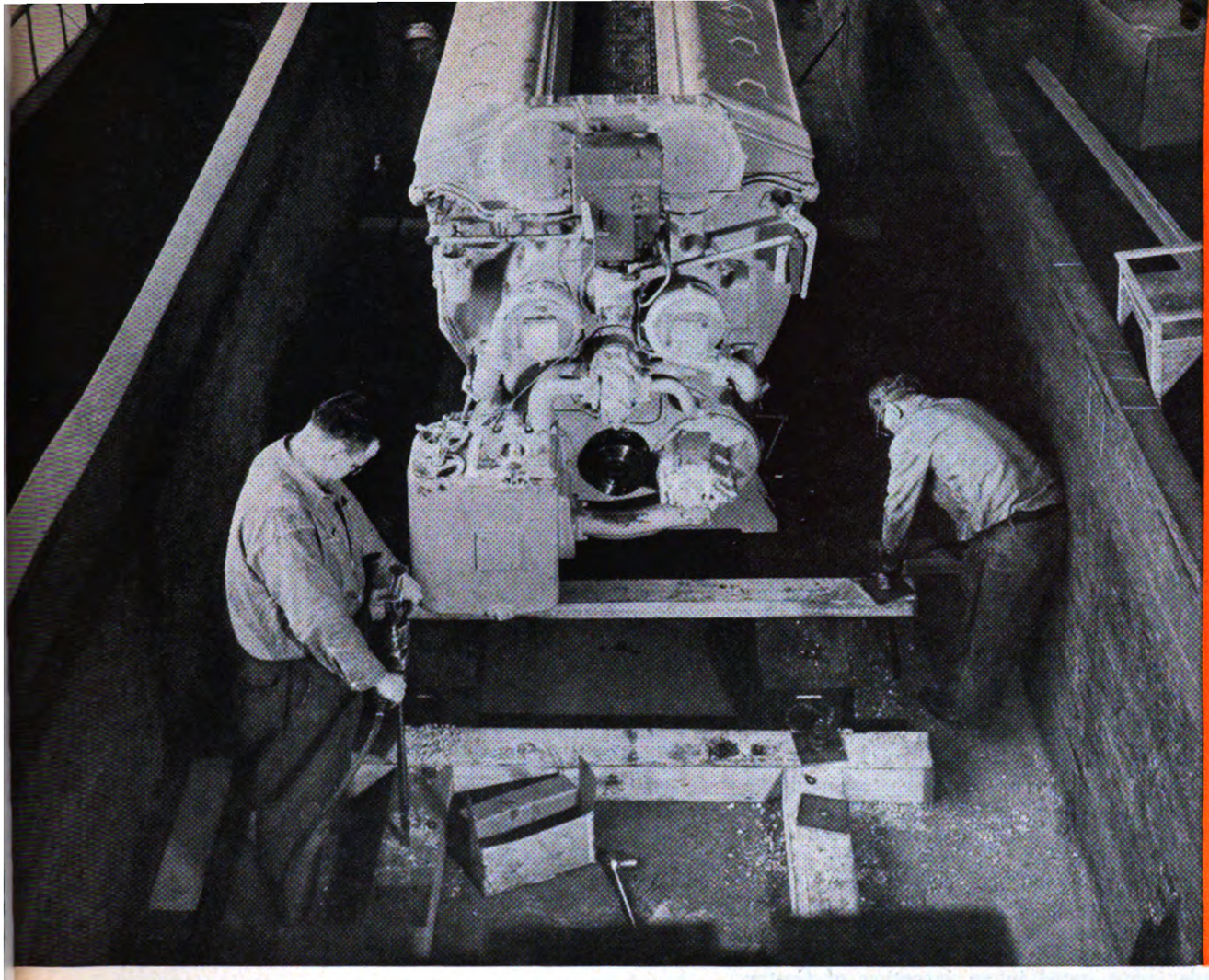
Hyatt freight car bearing assembly

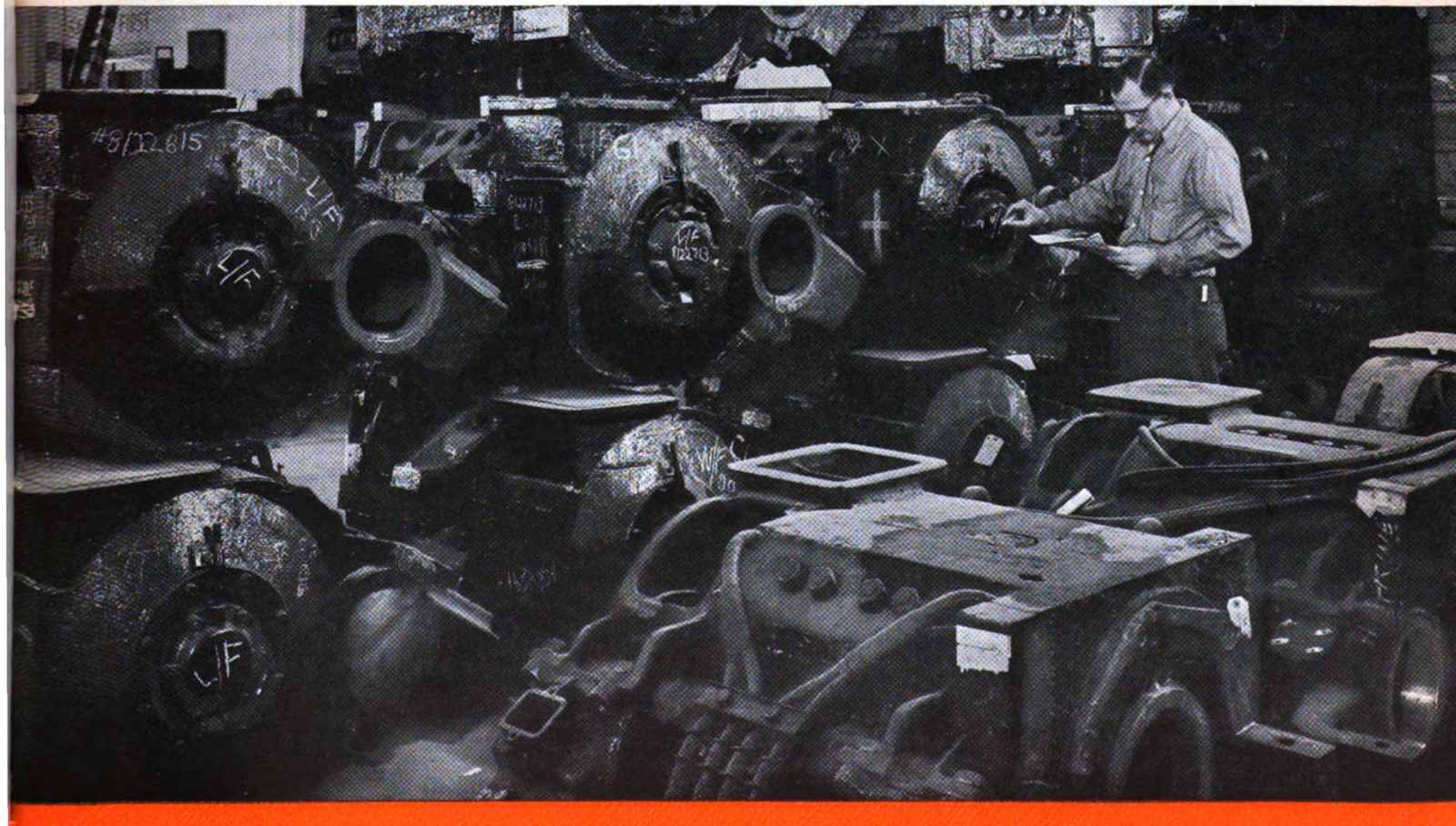


Hyatt freight-car journal bearing installed in the journal box of an integrally cast side frame



Sectional view of the Hyatt freight-car bearing unit assembled in the plain-bearing journal box




#8/12.815

The Hyatt freight-car journal boxes are grease lubricated. The bearings are of the straight radial type which are said to give maximum load-carrying capacity in the space provided. Thrust loads are taken against liberally proportioned race flanges. The radial construction of the bearings permits car axles to float laterally within predetermined limits, reducing sidewise shocks and wheel flange wear.

All bearing and box parts are accessible for cleaning and inspection. Both the journal boxes and the bearings can be removed from the car axles without breaking the race fits. Spare wheel and axle sets may be stored with the inner races, spaced and thrust rings in place, but without complete journal boxes, thus reducing spare parts inventories.

The Hyatt housings for integral box type side frames are designed so that they can be reversed top to bottom to present a new wearing surface in the bearing load zone. This increases the usable life of the unit.

How the bearings are assembled on the axle and inserted in the journal box is shown in the sectional view of the bearing unit in the journal box of an integrally cast freight-car truck side frame. The same procedure as to maintenance which has been developed on Hyatt journal boxes on diesel locomotives and passenger cars applies to the new line of freight-car bearings.

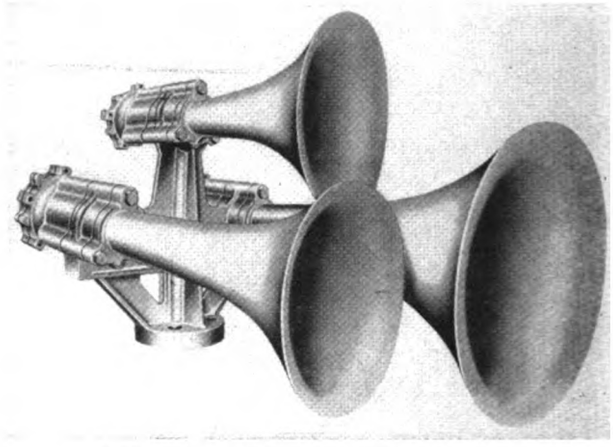
Leslie-Supertyfon Locomotive Horn

The chime type of air horn is a more pleasing sounding device than its brother, the single-tone air horn. Musical chords, considerations of overtones and fundamentals were the chief concern of the Leslie Co., Lyndhurst, N. J., in getting its Chime-Tone air horn to sound like the steam chime. The result is a multiple horn device ranging from two to five units, depending upon the chord and power desired.

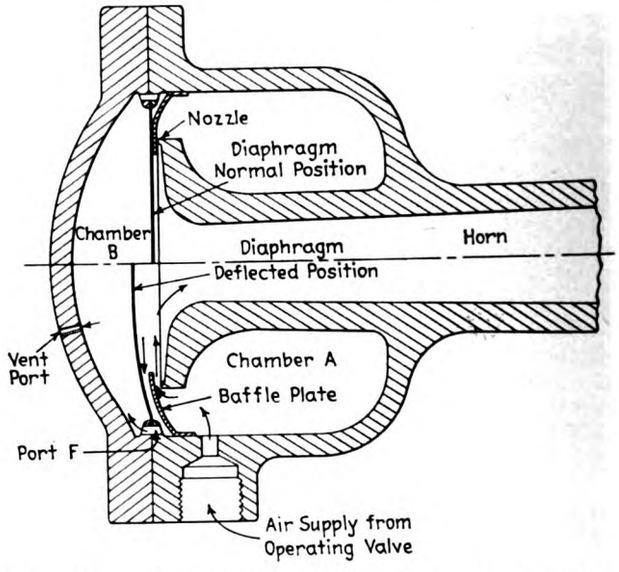
After working several years in developing tone, air consumption, power output and dependability of horns of this type the engineers of the Leslie Co. began a new series of investigations and finally have settled upon a new principle incorporated in an invention of Gustav Broden, development engineer of Kockums Mokaniska Verkstad Aktiebolag, Malmo, Sweden. Negotiations which involved conferences between the engineering departments of both companies culminated in a manufacturing agreement. The new horn is now known in the United States and Canada as Leslie-Supertyfon.

Generally, when high sound outputs are generated by a vibrating diaphragm, high stresses are experienced within the diaphragm and the constant flexing and reversal of the stresses causes the diaphragm to fail from fatigue. In the power chamber of the Leslie-Supertyfon a unique valving arrangement formed by the diaphragm itself as it vibrates permits the use of the operating air to move the diaphragm in both directions. As a result, it is possible to use a much lighter diaphragm of more flexible character than would normally be employed in such a device. The principle of operation is as follows: When the air-horn operating valve is opened to blow the horn, high-pressure air is admitted through a port to chamber *A*, building up the pressure in *A*. This pressure exerts a force on the diaphragm through the flexible baffle plate, tending to force it away from the nozzle and, at the same time, away from the baffle plate. As soon as the diaphragm moves away from the nozzle and baffle plate, air is permitted to escape past the diaphragm into the horn and at the same time through port *F* to the back of the diaphragm (chamber *B*). The build-up in pressure in chamber *B* exerts a force on the diaphragm, resisting further travel, and, by virtue of the greater effective diaphragm area exposed to chamber *B* as compared to chamber *A*, tends to restore it to its original position.

At the same time as the air pressure is being fed into chamber *B* and out through the horn the pressure in chamber *A* tends to fall, which also reduces the tendency



A three-tone Leslie-Supertyfon chime horn



Schematic section of the power chamber of the Leslie-Supertyfon horn

for the diaphragm to travel away from the nozzle and allows the pressure in chamber *B* to exert its restoring force. Pressure in chamber *B* also leaks off through the vent port in the cover to the atmosphere so that when the diaphragm has returned to its normal position against the nozzle and against the baffle plate, cutting off the supply to chamber *B*, the pressure will fall and the press-

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oil R.R.

UNIT Alco Diesel – 6 cyl. 12½" x 13" – 1000 H.P.

SERVICE Mountain haul – Heavy snow, extreme cold

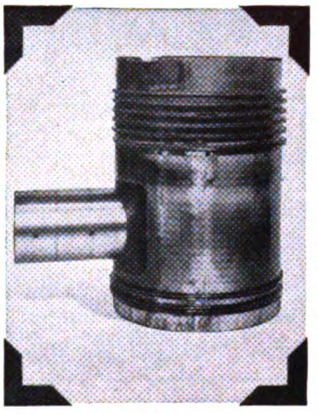
LOCATION Spokane, Wash.–Yahk, B.C.

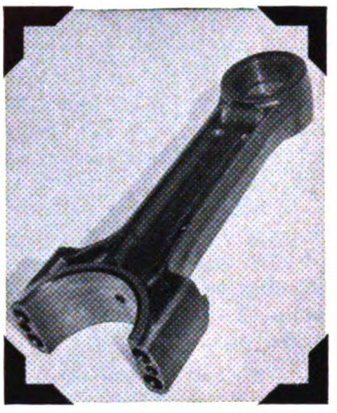
FIRM Spokane International R.R. Co.

Engines in "perfect condition" after year of toughest service!

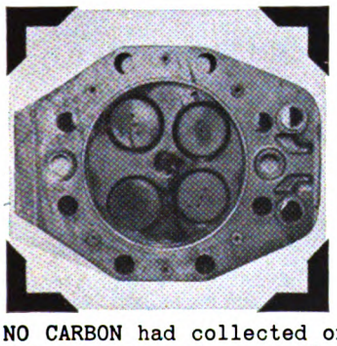


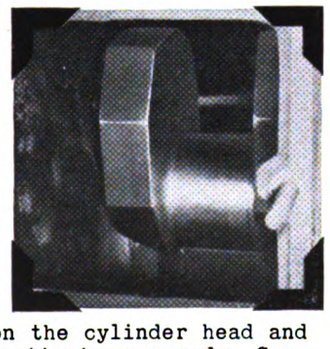
LUBRICATED WITH RPM DELO Oil R.R., nine new diesels owned by the Spokane International R.R. Company were kept in regular service for one year. The winter was exceptionally severe and the locomotives bucked heavy snow almost daily. They worked or were idled in temperatures that often for periods of ten days averaged from 20 to 40 degrees below zero.





On inspection at the end of that time there were no accumulations of sludge in oil systems and the engines were in "perfect condition" as pictures of parts from one of them indicate.



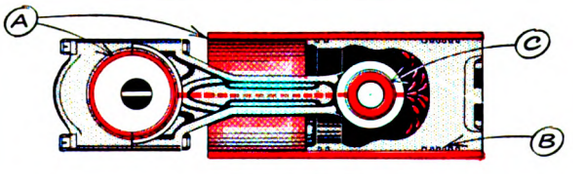


NO CARBON had collected on the cylinder head and all rings were free and functioning properly. Connecting-rod and main bearings and wristpin were within standard tolerance. Measurement of the liner showed less than 0.001 inch wear.

REMARKS: The Spokane International Railroad provides an important connecting service between transcontinental lines through Spokane and the Canadian Pacific to the north. Most of their trackage is in northern Idaho where severe weather and other conditions often make operation difficult. RPM DELO Oil R.R. will meet the toughest weather or operational conditions in all locomotive diesel engines.

RPM DELO LUBRICATING OILS

How RPM DELO Oil R.R. prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities . . . keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer . . . prevents ring-sticking. Detergent keeps parts clean . . . helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of bushing or bearing metals and foaming in crankcase.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street | San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 | Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 | El Paso, Texas

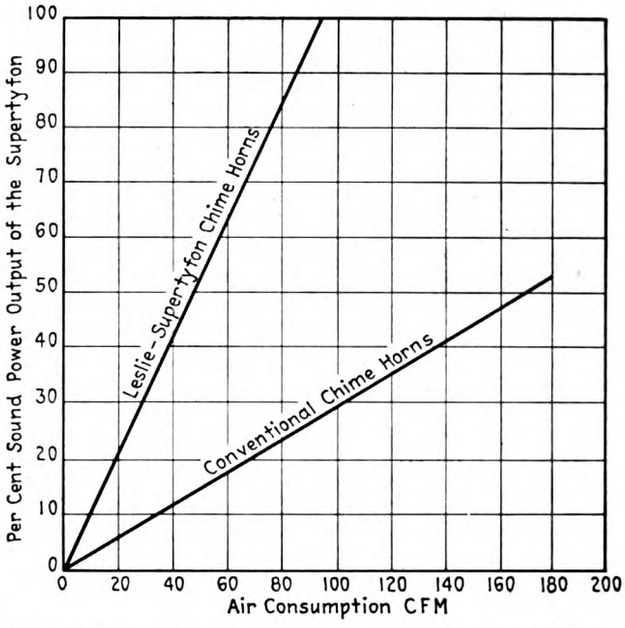
ure in chamber *A* will again rise to the point where the diaphragm can be deflected and the cycle repeated.

It is this patented valve action that keeps the diaphragm deflection and stress low and permits the use of a very thin flexible member which always operates at stresses well within its proportional limit and, as a consequence, gives long diaphragm life.

The use of the air in this new principle is extremely efficient and is best realized by referring to the graph of conventional air horns versus the Leslie-Supertyfon for power output versus air consumption. This records the results of comparative tests. The sound power output, which was measured in decibels, is plotted in per cent of the maximum output of the Supertyfon. It will be seen, for instance, that an output of 50 per cent of the new horn's capacity is produced with an air consumption of about 48 c.f.m., whereas the same sound output from a conventional horn requires an air consumption of 170 c.f.m., and that the full output of the new horn is produced with an air consumption of about 95 c.f.m.

There are no adjustments to be made or go out of order as the Leslie-Supertyfon is entirely self adjusting. Extensive tests in the United States and several years' service in Europe have verified the advantages of this type of horn.

In addition to the patented power chamber, the Leslie-Supertyfon incorporates a true musical instrument design of horn or bell and produces tones which, when sounded together as a musical chord, are said to be close to the tones of the old steam whistle which was built like an organ pipe.

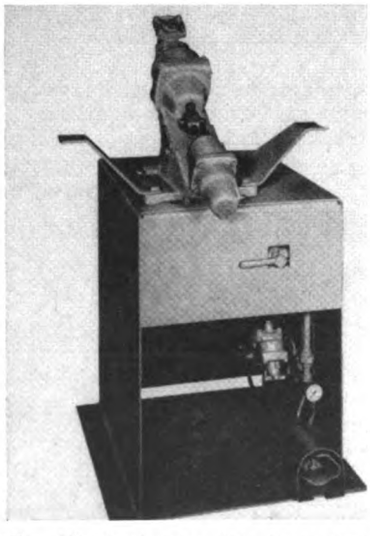


A comparison of sound power output in relation to air consumption of chime horns

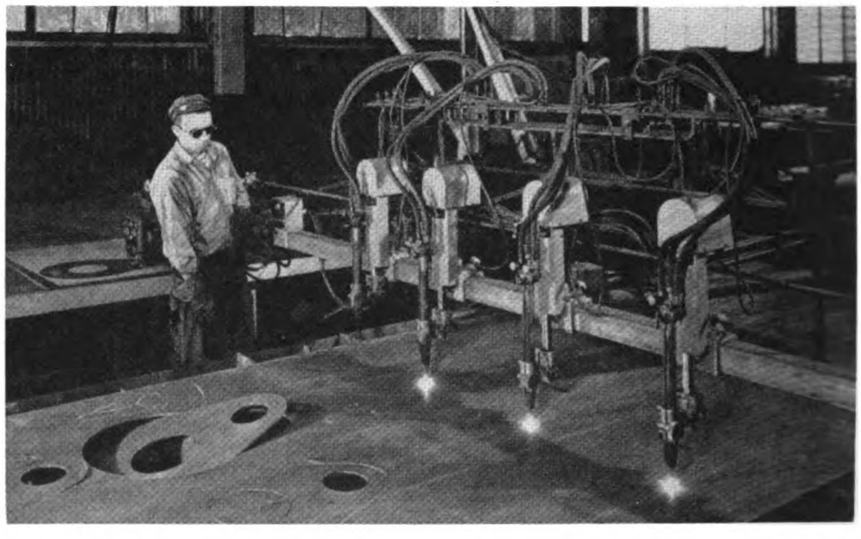
The Leslie-Supertyfon chime horn is available in a choice of chords to simulate different tyes of locomotive steam whistles and can also be used as a single-tone when desired.

Westinghouse Machine Applies Punch-Lok Clamps

A hose-clamping machine for applying Punch-Lok clamps to air-brake hose is now being marketed by the Westinghouse Air Brake Company, Wilmerding, Pa., after being under development for several years. This company has adopted these clamps as its standard for air-brake and signal hose. Designed to apply the clamps with uniform tension, this machine practically eliminates all of the manual effort formerly involved in clamp application.



The Westinghouse B-1 hose-clamping machine for applying Punch-Lok clamps



The machine is pneumatically operated and only three seconds are required to complete the clamping application cycle. The operator places the hose in the machine and presses the pedal. The whole sequence—clamp tightening, punch locking, and shearing of the clamp tail—occurs automatically. Preliminary studies of machines installed in railroad shops suggest that a single machine may be effectively used to consolidate several former stages when applying the bolt-and-nut clamps. The Punch-Lok clamps are packaged one thousand to a carton and are available for prompt shipment.

Motorized Cutting Torch Holder

Remote control raising and lowering of cutting torches of the Airco Oxygraph or Travograph type through 5 in. of travel has been made possible with the introduction of a motorized torch holder by the Air Reduction Sales Co., Division Air Reduction Co., Inc., New York 17.

The remote control switch box mounted on the 3 in. square torch bar of the Oxygraph or Travograph devices at the operator's control station, provides a switch

(*Continued on p.* 122)

KOPPERS K-Spun POROUS CHROME RINGS double mileage of railroad diesels . . . cut cylinder wear in half . . . slash maintenance costs



Koppers K-Spun Piston Rings, produced by centrifugal casting process, are *100% stronger . . . four times more resistant to combustion shock than ordinary rings! They will not break in installation or for the life of the engine.*

Koppers Porous Chrome* Rings have a porous chrome surface that holds and distributes oil during break-in, quickly wears down to perfectly seated solid chrome that prevents grit and other particles from embedding in the ring surface where they can scratch cylinder walls. Porous Chrome Rings last up to four times as long as other rings, reduce cylinder wear 50% or more.

That's why railroads everywhere are reporting amazing savings in equipment and maintenance costs through the use of Koppers Rings. Remember . . . we make rings for any equipment that uses piston rings.

*VAN DER HORST PROCESS

If you have a piston ring problem, why not get the *right* answer from us? Write, wire or phone Koppers Co., Inc., Piston Ring Dept., 1670 Hamburg St., Baltimore 3, Md.

KOPPERS

KOPPERS

AMERICAN HAMMERED

PISTON RINGS

SPECIFY: Fast's Couplings . . . Koppers Piston Rings . . . both famous products of the Koppers Co., Inc.

ONLY KOPPERS CAN FURNISH K-SPUN OR POROUS CHROME!

NEWS

Old Cast-Iron Car Wheels Will Help Make New Ones

CAST-IRON car wheels which are scrapped each year—amounting to about 550,000 tons—will henceforth be used only in the production of new cast-iron wheels, according to a recent order issued by the National Production Authority.

About 130,000 cast-iron car wheels are needed each month for maintenance and repair, N.P.A. announced. It said this means a monthly requirement of about 46,000 tons of cast-iron to keep freight cars in repair.

The new order provides that no person shall deliver or accept delivery of more than 10 tons of used cast-iron car wheels in any one month, except as authorized by N.P.A. Producers of new cast-iron wheels must certify in purchasing used wheels that the metal will go into the production of new freight car wheels.

Locomotive Builders Advisory Committee

THE National Production Authority, U. S. Department of Commerce, has announced the membership list of the Locomotive Builders Industry Advisory Committee as follows: W. S. Morris, vice-president, American Locomotive Company; R. N. Watt, vice-president, Baldwin-Lima-Hamilton Corporation; J. Horky, manager, Brookville Locomotive Works; George W. Koch, vice-president, Davenport Besler Corporation; V. H. Peterson, vice-president, Fairbanks, Morse & Company; G. W. Wilson, manager locomotive, and car equipment department, General Electric Company; B. A. Dollens, vice-president, Electro-Motive Division, General Motors Corporation; C. E. Pond, assistant to supt. motive power, Norfolk & Western; Roy J. Johnson, sales manager, Plymouth Locomotive Works; Joe E. O'Brien, sales manager, Vulcan Iron Works, and Chas. Olson, general manager, Whitcomb Locomotive Company.

B. & O. Turns Out Last Steam Locomotive

THE last steam locomotive to be repaired in the Glenwood maintenance shop of the Baltimore & Ohio near Pittsburgh, Pa., rolled out of the shop on August 31. Only diesel-electric locomotives are now maintained at this shop where the B. & O. has already spent nearly $900,000 of an allocation of more than a million dollars for the installation of new diesel facilities. Plans have also been made for the expansion of these facilities to take care of the constantly increasing number of diesel-electrics acquired by the road.

The last steam engine to be repaired was No. 1065, an eight-wheel switch locomo-

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE SEPTEMBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horsepower	Service	Builder
Boston & Maine	11[1]	1,600	Road-Switch	Alco-G. E.
	12	660	Switch	Alco-G. E.
	7	1,200	Switch	Electro-Motive
	9	1,500	Road-switch	Electro-Motive
Atlanta & St. Andrews Bay	2[1]	1,500		Electro-Motive
Missouri-Kansas-Texas	20[3]	1,200	Switch	Electro-Motive Baldwin-Lima-Hamilton
Seaboard Air Line	15[4]	1,500	Freight	Electro-Motive
	10	1,600	Passenger	Electro-Motive
Toledo, Peoria & Western	2[5]	1,500	Road-switch	Electro-Motive

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Burlington Refrigerator Express Co.	100	500-ton refrigerator	Pacific Car & Fdry.
Denver & Rio Grande Western	25[6]	70-ton covered hopper	Pullman-Standard
Detroit, Toledo & Ironton	100[7]	70-ton covered hopper	American Car & Fdry.
Grand Trunk Western	350[8]	50-ton box	American Car & Fdry.
	250	70-ton triple hopper	American Car & Fdry.
Gulf, Mobile & Ohio	250[9]	95-ton hopper	Pullman-Standard
Macon, Dublin & Savannah	2[10]	Cabooses	International Ry. Car & Equip. Mfg. Co.
Seaboard Air Line	400[4]	70-ton cement	Pullman-Standard
	600	50-ton gondola	Pullman-Standard
Tennessee Central	200[11]	50-ton hopper	Pullman-Standard
Texas & Pacific	25[12]	Cabooses	Company shops
Western Fruit Express Co.	300	Refrigerator	Pacific Car & Fdry.

FREIGHT-CAR INQUIRIES

Bessemer & Lake Erie	500	70-ton ore
Norfolk & Western	1,000	70-ton gondola
Western Pacific	300	70-ton gondola
	100	50-ton dump hopper
Virginian	1,000	50-ton hopper

[1] For delivery next year.
[2] Deliveries expected to begin next January.
[3] Number of units to be ordered from each builder not announced. To cost approximately $2,050,000. Delivery expected in February.
[4] Delivery of the motive power scheduled for December and January. Delivery of the freight cars scheduled for September and October, 1952.
[5] Estimated cost of each, $148,000.
[6] To cost approximately $182,500. Delivery expected during the third quarter of 1952.
[7] Delivery scheduled for the third quarter of 1952.
[8] The cost of the box cars is estimated at $2,257,000; the hopper cars, $1,528,000. Delivery expected during the late summer of 1952.
[9] The cost of the hopper cars is estimated at $2,400,000. Delivery is scheduled for late 1952 or early 1953.
[10] Estimated cost, $23,200. Delivery expected during the last quarter of this year.
[11] Approximate cost, $980,000. Delivery scheduled for the summer of 1952.
[12] To be built sometime during 1952, actual construction date depending on availability of necessary materials.

NOTES:

Erie.—The board of directors of the Erie has authorized the purchase of 13 additional diesel-electric locomotive units costing an estimated $1,900,000. According to Paul W. Johnson, president, when delivery is made of 15 units recently ordered, and the 13 just authorized, the Erie "will be within striking distance of its goal of complete dieselization." Steam locomotives are now in use on only three of the road's divisions.

Long Island.—The Long Island has requested bids for double-deck 132-passenger coaches similar to 63 it already has in service, and four modified single-deck coaches of a new 3-2 seat type, each of which would be longer than present single-deck cars and should seat nearly as many passengers as a double-deck car. At east 20 cars of one type or the other will be purchased.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599

GOULD



REGULAR WATER ADDITIONS

ADD MONTHS TO BATTERY SERVICE!



Specialized equipment makes the watering of car lighting batteries on the road, quick and easy.

The amount of water used by a battery indicates its general condition. That's why regular, systematic watering is so important to maximum battery service. The GOULD PLUS-PERFORMANCE PLAN gives you complete technical information, not only on how to establish a regular watering routine, but on practically every problem connected with storage battery use.

Comprising manuals, articles, specifications, bulletins, charts, graphs and forms, the GOULD PLUS-PERFORMANCE PLAN tells you how to select, charge and handle, maintain and determine the condition of your batteries. Use it consistently and you can improve your battery performance as much as 50%! All material is free. A request will bring descriptive booklet by return mail.

WATERING ROUTINE HELPS KEEP CARS IN SERVICE

Regular watering routine on the road is essential for top battery efficiency and maximum service. When adding water, fill to ⅛" below bottom of filling tubes and no higher. Over-filling results in overflow of electrolyte and subsequent rotting of the wood trays. It also lowers the gravity, reduces battery capacity, damages the battery compartment and causes corrosion and grounds.

As a general rule, a battery in good condition, using more than ½" of water per month, is receiving too much charge. If it uses less than approximately ¼" per month, it is not receiving sufficient charge. All cells should require the same amount of water. If one cell takes more than others, it should be examined for leakage or internal trouble.

Gould "Z" Plate Batteries—America's Finest Car Lighting and Air Conditioning Batteries

GOULD **STORAGE BATTERIES**

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

tive. When the Glenwood locomotive maintenance shop was completed in 1919, it contained every modern facility for the repair of steam locomotives and it had a capacity of 500 class, or major, repair jobs a year. Its cost was more than two million dollars. With the new installation for diesel repairs now completed in the shop, it will be possible to do heavy repair jobs on about 200 diesel locomotive units a year, besides handling repairs to component parts, such as traction motors, main generators, engines, injectors, governors, etc.

Beale Becomes Director Ry. Equip. Div., N.P.A.

GUY O. BEALE of Cleveland, Ohio, has been appointed director of the Railway Equipment Division of the National Production Authority, U. S. Department of Commerce. Mr. Beale, who will be on leave as vice-president of the Chesapeake & Ohio, will head the N.P.A. operating



Guy O. Beale

division which has the basic responsibility for allocating controlled materials to the nation's railroad industry, including car and locomotive builders.

Robert Glenn of Sanford, Florida, who has been hitherto serving as acting director of the division will continue as deputy director under Mr. Beale.

Roads Asked Not to Scrap Heavier Type Locomotives

IN a recent letter to the railroads, Defense Transport Administrator James K. Knudson asked the carriers not to scrap any usable coal-burning steam locomotives having 50,000 lb. of tractive force or over. The request also covered such locomotives that can be made usable without excessive use of critical materials.

Roads receiving diesel-electric power and planning to scrap steam locomotives of this size should notify the D.T.A., Mr. Knudson said. He asked that such notification set forth in detail the facts and reasons scrapping is desired, and he promised D.T.A. would take prompt action on such notices.

Mr. Knudson said his letter to the railroads was to help them get a clearer understanding of what was desired at a time when they were being urged to increase their scrap contributions.

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of May 1951	Month of May 1950	Five Months ended with May 1951	Five Months ended with May 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	25,455	29,145	134,229	136,221
3-06	Total, Diesel-electric	23,106	17,047	105,856	80,596
3-07	Total, electric	853	824	4,126	4,017
3-04	Total, locomotive-miles	49,415	47,020	244,230	220,857
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,774	1,612	8,638	7,402
4-06	Empty, total	928	864	4,298	4,039
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	45,024	49,684	229,599	219,303
6-02	Total in oil-burning steam locomotive trains	12,781	12,516	61,329	55,883
6-03	Total in Diesel-electric locomotive trains	65,365	48,131	295,974	226,603
6-04	Total in electric locomotive trains	2,388	2,170	11,328	10,476
6-06	Total in all trains	125,567	112,524	598,320	512,369
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.05	1.05
10-02	Loaded freight car-miles	39.70	38.30	39.30	37.40
10-03	Empty freight car-miles	20.80	20.60	19.60	20.40
10-04	Total freight car-miles (excluding caboose)	60.50	58.90	58.90	57.80
10-05	Gross ton-miles (excluding locomotive and tender)	2,813	2,677	2,724	2,590
10-06	Net ton-miles	1,316	1,217	1,273	1,162
12	Net ton-miles per loaded car-mile (M-211)	33.10	31.70	32.40	31.10
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	65.70	65.10	66.80	64.70
14	Averages per train hour (M-211):				
14-01	Train miles	17.30	17.10	16.90	17.00
14-02	Gross ton-miles (excluding locomotive and tender)	47,942	45,168	45,414	43,480
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	46.50	44.70	46.00	42.50
14-02	All	44.40	41.70	44.00	39.50
15	Average net ton-miles per freight car-day (000) (M-240)	964	860	950	795
17	Per cent of home cars of total freight cars on the line (M-240)	39.20	42.30	36.10	46.50
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	9,989	11,485	54,525	56,022
3-06	Diesel-electric	16,504	14,059	78,556	69,918
3-07	Electric	1,632	1,546	8,083	7,910
3-04	Total	28,124	27,090	141,164	133,850
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	270,704	252,756	1,360,916	1,281,535
4-09	Total in coal-burning steam locomotive trains	51,857	58,260	287,447	283,019
4-10	Total in oil-burning steam locomotive trains	32,024	33,692	166,383	171,838
4-11	Total in Diesel-electric locomotive trains	16,4995	144,592	820,796	740'668
12	Total car-miles per train-miles	9.41	9.10	9.49	9.33
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,223	1,415	6,549	6,945
1-02	Steam, oil-burning	244	234	1,230	1,108
1-03	Diesel-electric[1]	2,988	2,454	14,441	11,659
1-06	Total	4,481	4,130	22,353	19,843
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	48	56	258	307
2-02	Steam-oil-burning	12	12	66	64
2-03	Diesel-electric[1]	244	222	1,196	1,104
2-06	Total	338	324	1,689	1,644
3	Hours per yard locomotive-day:				
3-01	Steam	7.60	7.70	8.10	7.50
3-02	Diesel-electric	17.30	17.10	17.60	17.30
3-05	Serviceable	14.20	13.70	14.50	13.80
3-06	All locomotives (serviceable, unserviceable and stored)	12.20	11.50	12.60	11.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.74	1.77	1.78	1.85
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.78	0.80	0.77	0.80

[1] Excludes B and trailing A units.

GOOD ENOUGH*

We must beware of "good enough."
It isn't made of sterling stuff.
It's something any man can do,
It marks the many from the few.
It has no merit to the eye,
It's something any man can buy.
Its name is but a sham and bluff,
For it is never "good enough."

With "good enough" the shirkers stop,
In every factory, school and shop,
With "good enough" the failures rest
And *lose* to men who give their best.
With "good enough" the car breaks down,
And many fall short of high renown;
We must, remember and be wise,
In "good enough" disaster lies.

With "good enough" have ships been wrecked.
The forward march of armies checked.
Great buildings burned and fortunes lost,
Nor can the world compute the cost
In life and money it has paid
Because at "good enough" man stayed.
Who stops at "good enough" shall find
Success has left him far behind.

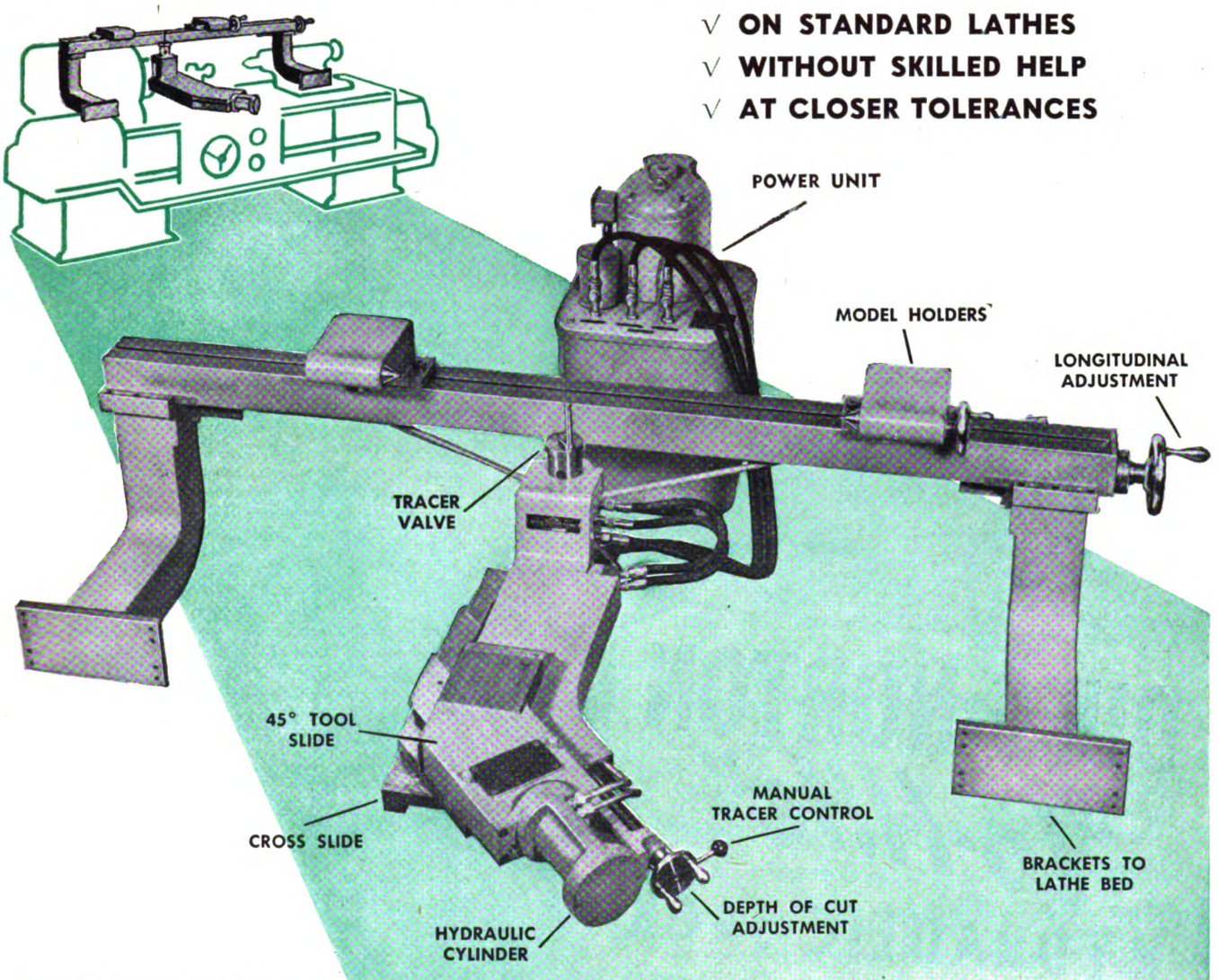
There is no "good enough" that's short
Of what you can do and you ought;
The flaw which may escape the eye
And temporarily get by.
Shall weaken underneath the strain
And wreck the shop or car or train,
For this is true of men and stuff,
Only the best is "good enough."

* Written and presented by E. P. Fairchild, General Boiler Inspector, Atlantic Coast Line, before a meeting of the Safety Committee Secretaries Conference at Jacksonville, Fla., on June 8, 1951.

Here's how locomotive shops using Turchan Follower Attachments

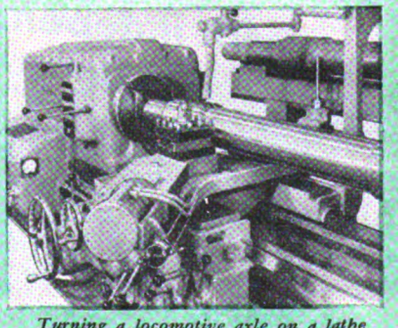
Get 4 to 6 times faster production

√ ON STANDARD LATHES
√ WITHOUT SKILLED HELP
√ AT CLOSER TOLERANCES



The Turchan Follower Attachment is a hydraulic duplicator that replaces the regular cross slide, operating at a 45° angle to the work axis. The cutting tool takes uninterrupted cuts and reproduces the model to tolerances of .001". Jobs such as motor shafts, spindles, valve stems, back shafts, piston rods, axles—in fact, any shaft regardless of length, number of steps, tapers and radii is ideally produced on Turchan equipped lathes. Hydraulic duplicator attachments increase the versatility of your present machines, and eliminate the need for special form tools. There are also Turchan attachments for milling machines, planers, shapers and grinders. "Turn to Turchan to cut costs."

SEND FOR DESCRIPTIVE FOLDER



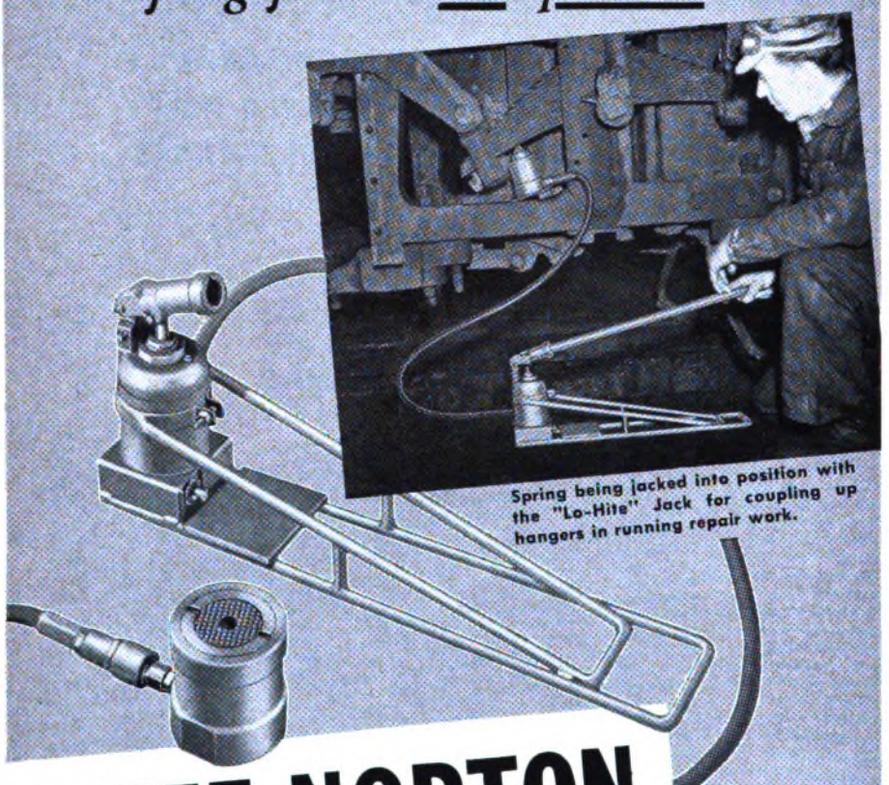
Turning a locomotive axle on a lathe equipped with the above Turchan duplicating attachment, in 2 hours instead of 8 hours.

WRITE US TODAY: Send a sketch and specification of any lathe job. Give make of machine. We'll show you how to produce it better, faster, at lower cost.

Turchan FOLLOWER MACHINE CO. 8259 LIVERNOIS AVENUE DETROIT 4, MICH.

OLDEST MANUFACTURER OF HYDRAULIC ATTACHMENTS FOR MACHINE TOOLS

For renewing locomotive spring pins, shackle pins, wearing pads, and for all lifting jobs in low quarters



Spring being jacked into position with the "Lo-Hite" Jack for coupling up hangers in running repair work.

DUFF-NORTON
"Lo-Hite"
HYDRAULIC JACK
... with independent pump

Notice in the photo above that the jack (only 4½" high) is spotted in a closely confined area while the independent pump is out in the open, making jacking easy. This jack will lift a 30 ton load two inches—can be used in vertical or horizontal position.

Write for Bulletin AD-3R.

STRENGTH, SAFETY, DURABILITY — DUFF-NORTON JACKS — ESTABLISHED 1883

THE DUFF-NORTON MANUFACTURING CO.

MAIN PLANT and GENERAL OFFICES, PITTSBURGH 30, PA.—CANADIAN PLANT, TORONTO 6, ONT.

"The House that Jacks Built"

SUPPLY TRADE NOTES

GENERAL MOTORS CORPORATION.—The *Hyatt Bearings division* of General Motors has completed preliminary plans for expansion of manufacturing areas in its Harrison, N. J., and Clark Township plants. New structures at the Clark Township plant will provide an additional 390,000 sq. ft. of floor space, doubling existing facilities, and alterations to the Harrison plant will provide an additional 12,000 sq. ft. of manufacturing area.

◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—Independent Pneumatic Tool Co., Aurora, Ill., has transferred its Cincinnati branch to a new, modern building at 3726-3726-28 Floral avenue.

◆

PENNSYLVANIA SALT MANUFACTURING COMPANY.—This company has opened a district sales office at 1618 Irwin-Keasler building, Dallas, Tex. The new office will be sales and service headquarters for Texas and Oklahoma and will be headed by *Hugh W. Temple*, district sales manager.

◆

AMERICAN STEEL & WIRE CO.—*Thursman Haskell* has been appointed special representative in the western area sales department of American Steel & Wire, with headquarters in Chicago. Mr. Haskell has been with the company (a subsidiary of U. S. Steel) since 1919. He has been sales manager at Salt Lake City and at Denver.

◆

JOSEPH T. RYERSON & SON, INC.—*Paul L. Wright* has been appointed sales manager of the Ryerson plant at Buffalo, N. Y. Mr. Wright formerly was office manager, in which capacity he served also as supervisor of the company's inside sales department.

◆

AMERICAN BRAKE SHOE COMPANY.—*Arthur N. Dugan*, vice-president of the *National Bearing Division* of American Brake Shoe, has retired after 37 years of service. Mr. Dugan will continue with the company as a consultant.

◆

MERCURY MANUFACTURING COMPANY.—*Frank M. Ruse* has been appointed midwest transportation sales representative for the Mercury Manufacturing Company, Chicago.

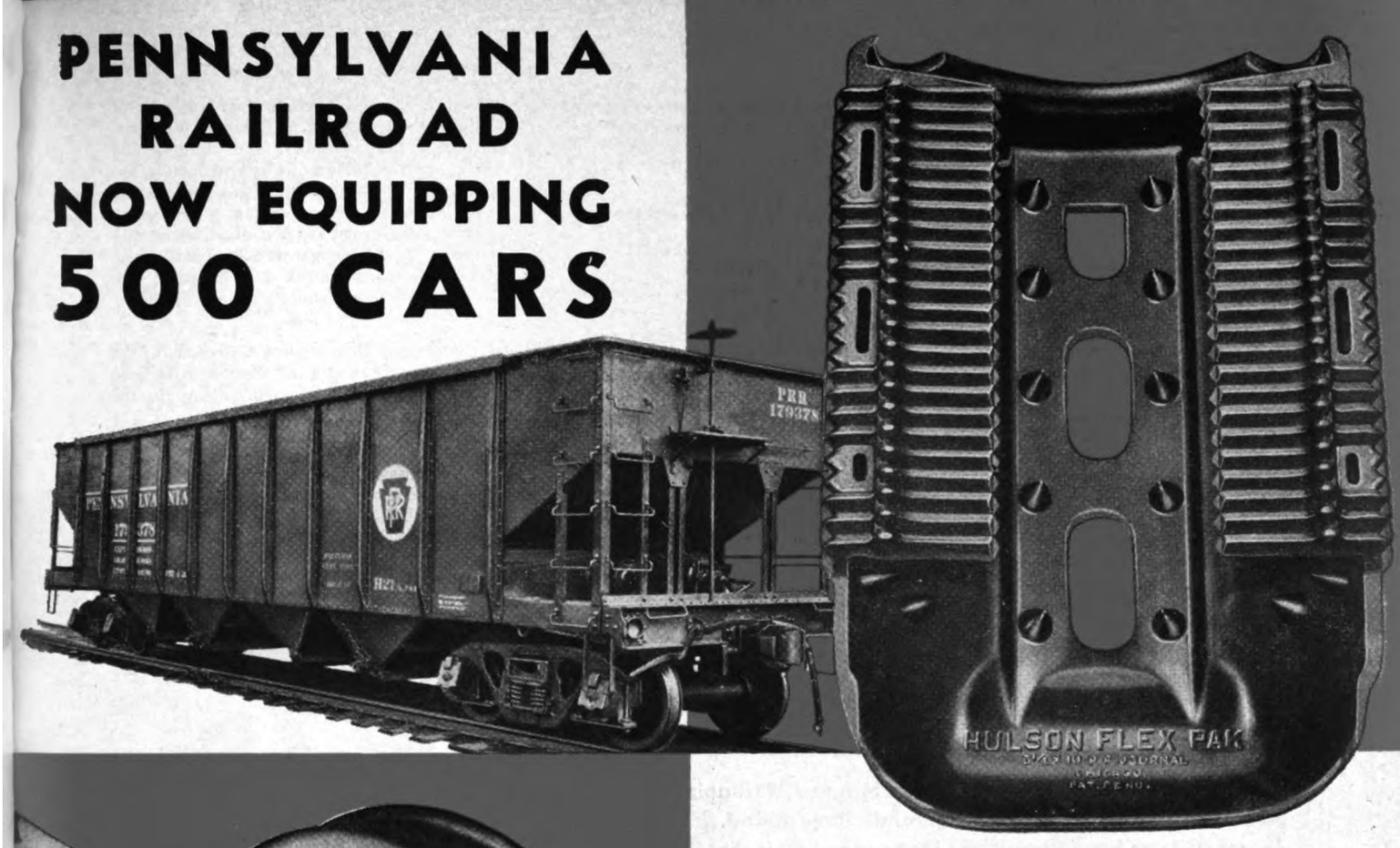
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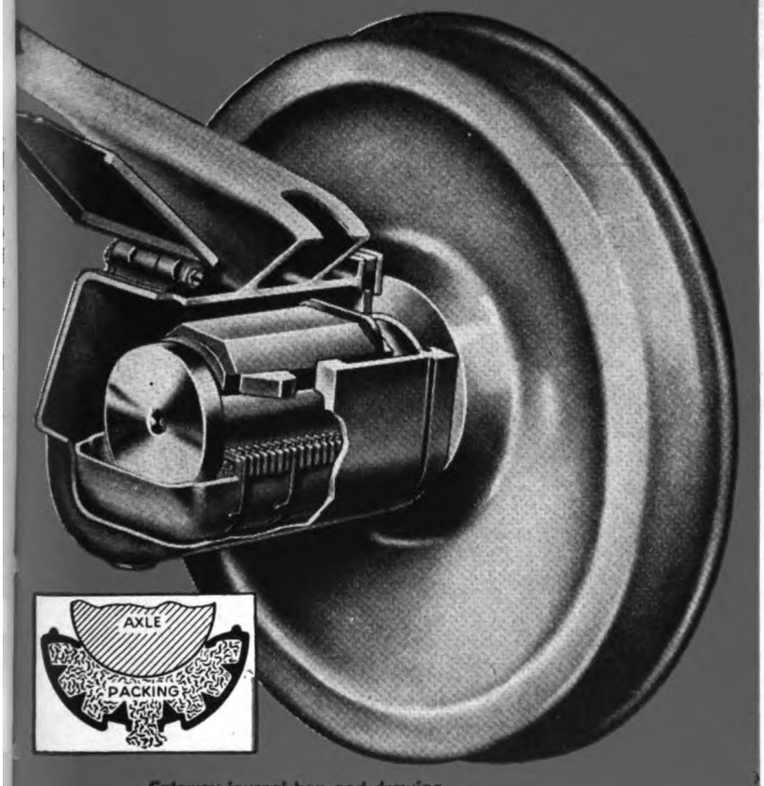
FLEXITALLIC GASKET COMPANY.—The Flexitallic Gasket Company, Camden, N. J., has appointed *Hyslop Brothers*, Chicago and Los Angeles, as agent serving the railroad industry.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—The National Malleable & Steel Castings Co. will build a new physical testing laboratory for railway engineering development work, at Cleveland, at a cost of $750,-

PENNSYLVANIA RAILROAD NOW EQUIPPING 500 CARS





Cutaway journal box and drawing shows Flex-Pak in position in box.

IN CONTINUATION OF TESTS instituted more than a year ago, the Pennsylvania Railroad is equipping 500 70-Ton Class H21A hopper cars with the Hulson Flex-Pak.

The Hulson Flex-Pak is a new type of journal waste container and retainer of synthetic rubber composition. Compounded to be oil resistant, Flex-Pak provides a resilient cushion holding the waste against the full length of journal at the proper pressure for adequate lubrication under all conditions of transit, impact, and temperature. Flex-Pak replaces approximately ½ of the journal packing.

HULSON CO.

332 SOUTH MICHIGAN AVENUE CHICAGO 4, ILLINOIS

HULSON FLEX-PAK®

A.A.R. APPROVED AND PROTECTED IN INTERCHANGE

We can now supply reasonable quantities of Flex-Pak for 5 x 9, 5½ x 10 and 6 x 11 standard A.A.R. freight car journals.



Application bulletin #1 is now being distributed to our mailing list. Additional copies will be mailed promptly on request.



These Roads *have proved* that Mechanized Cleaning of Diesel Parts Saves Time and Labor Costs!

There's nothing like actual use of the Magnus Mechanized Method to prove its worth—as these railroads have found. Many of the larger systems have completely Magnusized their diesel shops and outlying points. Why?

The Magnus Method thoroughly cleans more parts in one-tenth the time normally required in a soak tank or vat. It eliminates up to 95% of hand labor, and saves up to 60% in material cleaning costs. And, initial equipment-chemical costs are surprisingly low.

MECHANIZE TO SAVE! The Magnus Aja-Dip with Magnus Decarbonizing Compound speeds cleaning of these average diesel parts:

Heads . . . . . 2 hours	Blowers . . . . . 20 minutes
Liners . . . . . 2½ hours	Valves . . . . . 50 minutes
Rods . . . . . 20 minutes	Strainers . . . . 10 minutes
Pistons . . . . . 20 minutes	Misc. Parts, 5 to 12 minutes

Cleaning the Magnus way is only a one-man operation.

Why go along with slow, costly, outdated cleaning methods when mechanizing with Magnus CAN save your road real money? Phone or write for complete information.

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

000. Kenneth L. Selby, chief engineer of the railway division, will direct the activities of the laboratory. The building and test tracks will occupy approximately five acres of land acquired for this purpose and the main laboratory building, to be located on Woodhill road and Woodland avenue adjacent to the company's Cleveland works, will have about 14,000 sq. ft. of space, with completely independent service facilities.

◆

AMERICAN BRAKE SHOE COMPANY.—*John F. Ducey, Jr.*, and *S. R. Watkins* have been appointed assistant vice-presidents in the



J. F. Ducey, Jr.



S. R. Watkins

sales department of the Brake Shoe & Castings division of American Brake Shoe. Both men formerly were district sales managers for the division.

◆

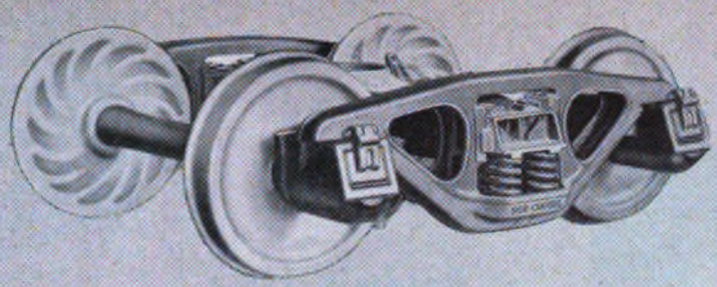
MICROMATIC HOME CORPORATION. *William H. Harris, Jr.*, has been elected vice-president in charge of engineering at Detroit. Mr. Harris was previously chief engineer.

◆

GENERAL MOTORS CORPORATION.—The *Hyatt Bearings Division* of General Motors Corporation has announced the appointment of *Frank H. Webster* as assistant manager—western division, Chicago.

◆

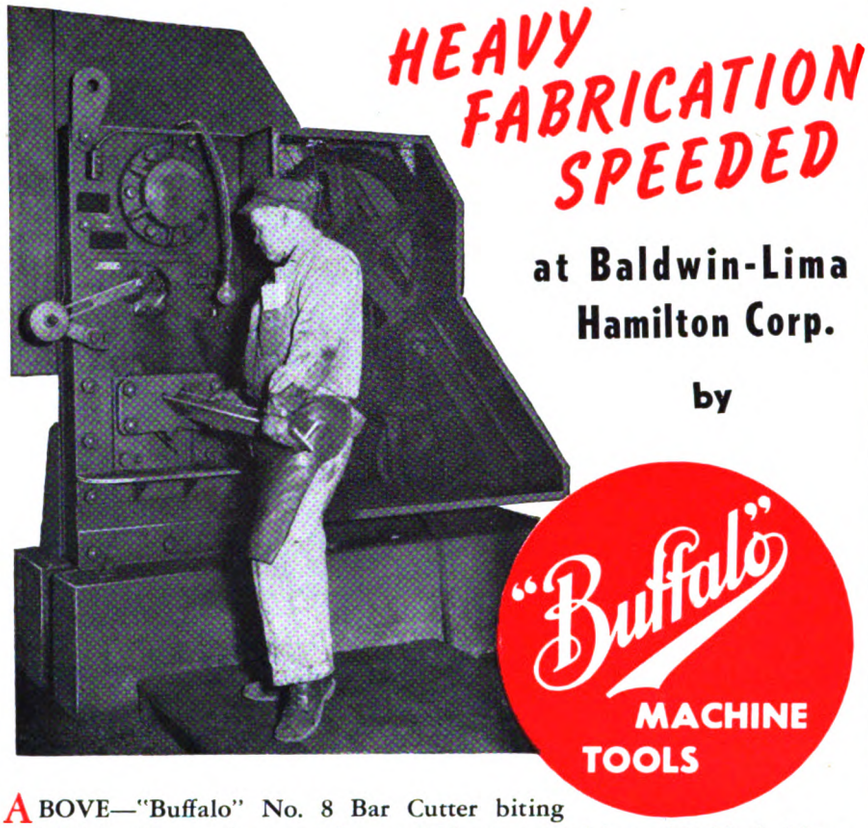
BOWSER, INC.—Bowser, Inc., Chicago, has acquired ownership of the *National Scientific Laboratories, Inc.*, 2010 Massachusetts



More Users buy more A-S-F Ride-Control Trucks than all other trucks combined... because Ride-Control® is smooth-riding, long-lasting--- cuts operating costs!

American Steel Foundries

Mint Mark of ○ Fine Products



HEAVY FABRICATION SPEEDED

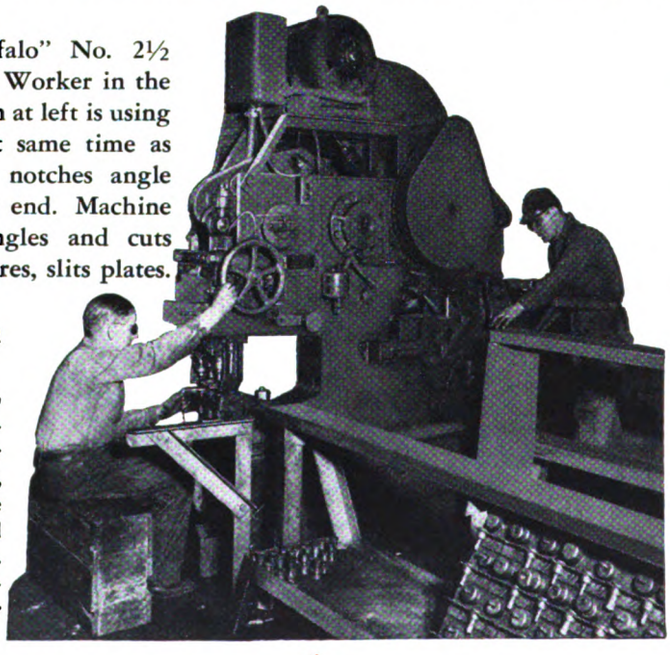
at Baldwin-Lima Hamilton Corp.

by

"Buffalo" MACHINE TOOLS

ABOVE—"Buffalo" No. 8 Bar Cutter biting off 4½ by ⅝ tee clean and fast at Eddystone Division of Baldwin-Lima-Hamilton Corp. in Philadelphia. Machine can operate at a rate of 25 strokes per minute, and can also handle angles, flats, rounds, squares, channels and beams. Massive arc-welded plate frame gives full rigidity for long life.

RIGHT—"Buffalo" No. 2½ Universal Iron Worker in the same shop. Man at left is using punch head at same time as man at right notches angle iron on shear end. Machine also mitres angles and cuts rounds or squares, slits plates.



WHAT IS YOUR PROBLEM?

If it has to do with drilling, cutting, punching or bending metal, "Buffalo" has the machine to speed up the operation. Write us for bulletins on your problem.

BUFFALO "Buffalo" FORGE COMPANY

174 Mortimer St. Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

avenue N. W., Washington, D. C. *Robert I. Sarbacher*, president of National, has been appointed also director of research for Bowser, and will head the product development work of all subsidiary companies. There will be no changes in laboratory personnel.

◆

ALUMINUM COMPANY OF AMERICA.—The Aluminum Company of America is expanding its research facilities with the erection of a new building at the company's Aluminum Research Laboratories at New Kensington, Pa. The new unit, 80 ft. by 170 ft., will increase total floor space at the laboratories by about one-third. Construction is already under way, and the building will be ready for occupancy early next year. The new addition will consist of two bays, one of which will be three stories high, the other two stories. A six-ton mill-type crane will be installed in the first bay to handle heavy research equipment.

◆

PITTSBURGH STEEL COMPANY.—*Charles F. Palmer*, for many years manager of railway sales for the Pittsburgh Steel Company, retired from active duty on August 31. He has been succeeded by *William G. Gray* who has been with Pittsburgh Steel since 1944 as railway development engineer on tubular railway axles.

◆

DEDNOX, INC.—The *Spring Packing Corporation*, of Chicago, has been appointed exclusive national distributor for the railway products of Dednox, Inc., also of Chicago.

Obituary

IDA R. SIMMONS, a director of the Simmons-Boardman Publishing Corporation, publishers of *Railway Mechanical and Electrical Engineer*, died on September 20 at her home in New Rochelle, N. Y., at the age of 66. Mrs. Simmons was a former employee of the publishing company, having joined its service while still in her teens. In 1914 she was married to the late Colonel Edward A. Simmons, then president of the company. Following his death in 1931, she was elected a member of the directorate and thereafter maintained an active association with the company in which she held a large stock interest.

◆

C. ARTHUR DUNN, retired manager of railroad sales division, Ex-Cell-O Corporation, died at his home in Detroit on August 28 following a long illness. Mr. Dunn was born in Detroit on December 23, 1884. He served as general superintendent of the Globe Seamless Steel Tube Company in Milwaukee and subsequently joined the Prime Manufacturing Company also of Milwaukee as manager railroad sales. He joined Ex-Cell-O September 16, 1930, where he served until retirement.

◆

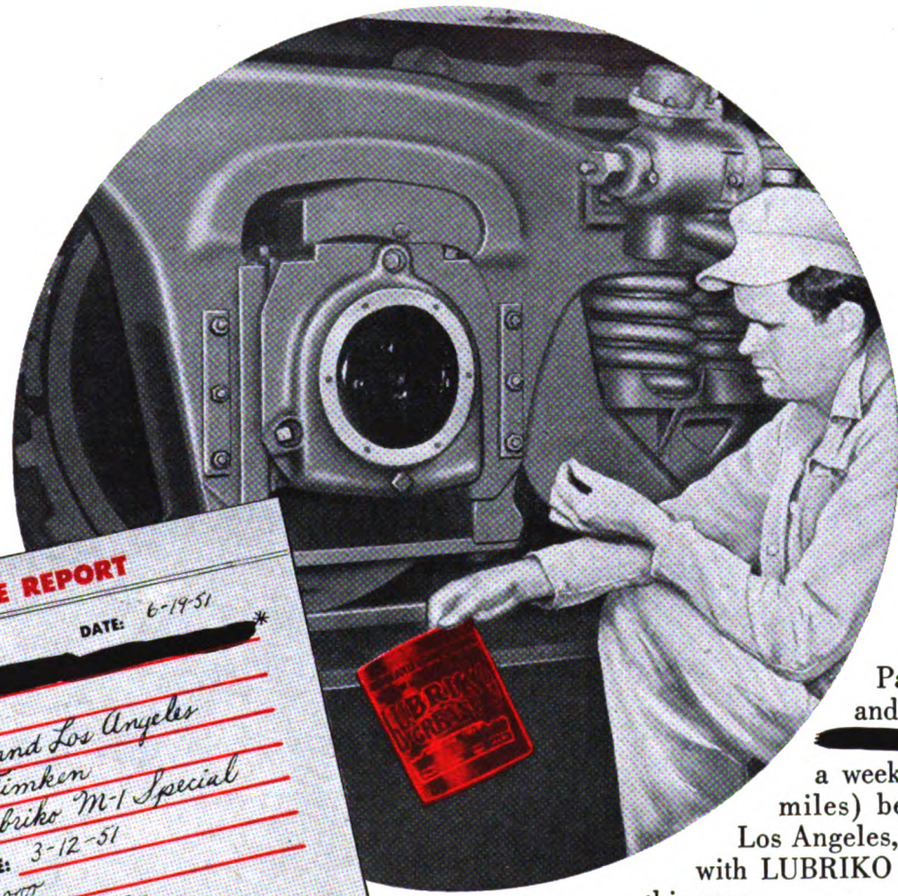
DAVID W. PYE, who retired recently as president of Tuco Products Corporation and as executive secretary-treasurer of the New York Railroad Club, died in New York on September 8, after an illness of many months.

Mr. Pye was born in Brooklyn, N. Y., on November 5, 1876. After receiving a

43 TIMES FARTHER with LUBRIKO GREASE

M-1 SPECIAL!

A.A.R. APPROVED FOR INTERCHANGE



SERVICE REPORT

DATE: 6-19-51

RAILROAD: [redacted]*

CAR #: 2925

RUN: Chicago and Los Angeles

BEARING TYPE: Timken

LUBRICANT: Lubriko M-1 Special

STARTED SERVICE: 3-12-51

MILEAGE: 108,000

FINDINGS: GREASE LEVEL: OK
ROLLERS: Well coated
GREASE TEXTURE: Good
GREASE COLOR: Good
CIRCULATION:
JOURNALS CHECKED: all

GREASE ADDED: None

REPORT BY: MMP

Passenger cars #2925 and #2930 on the [redacted]*, which makes a weekly round trip (4500 miles) between Chicago and Los Angeles, were test lubricated with LUBRIKO M-1 on March 12 of this year.

On June 19, after 108,000 miles of service, these cars were checked. No servicing was required—no additional lubrication was added.

Other cars (not LUBRIKO lubricated) in this same passenger train had to be lubricated every 2500 miles or, during the same period, 43 times.

** Name on request.*

Write today for LUBRIKO Railroad Case Histories!

You are SAFE with LUBRIKO

THE MASTER LUBRICANT

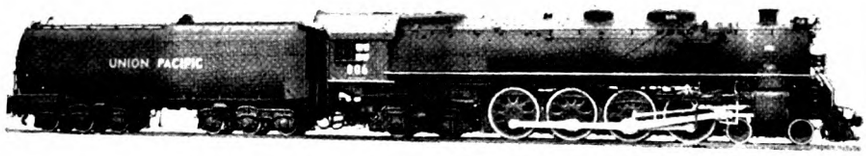
THE TEST TELLS

MASTER LUBRICANTS COMPANY CHICAGO

MANUFACTURERS OF HIGH-GRADE INDUSTRIAL LUBRICANTS FOR OVER 60 YEARS

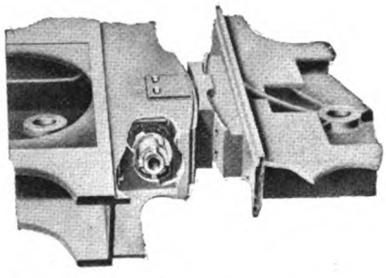
LOS ANGELES • BOSTON • SAN FRANCISCO

CUT locomotive maintenance COSTS



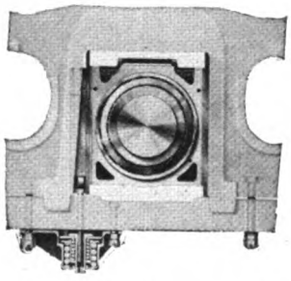
with these TWO SHOCK ABSORBERS

The Franklin E-2 Radial Buffer



The Franklin E-2 radial buffer reduces maintenance by dampening and absorbing horizontal shake and vertical vibration. This results in less wear on chafing plates, drawbars and pins; fewer pipe failures; less displaced brickwork; and fewer loose cabs. It requires minimum attention and will make any locomotive, at any speed, a better riding engine. Crews appreciate the greater comfort it brings.

The Franklin Compensator and Snubber—Equally important with roller-bearing or surface-bearing locomotives, the Franklin Compensator and Snubber keeps the driving box or housing snug in the pedestal jaw, regardless of expansion or wear. It will absorb unusual thrusts and shocks. Driving box pound is eliminated. Wear and the possibility of failure of crank pins and rod bearings are minimized. Tire mileage is extended by reduction of quarter slip.



REG. U.S. PAT. OFF.

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER
POWER REVERSE GEARS • FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS
JOURNAL BOXES • FLEXIBLE JOINTS • TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

business college education, he entered the railway supply business and was purchasing agent and vice-president of the Safety Car Heating Company before he became associated with Tuco Products, which he later came to head.

Mr. Pye became treasurer of the New York Railroad Club in 1918 and was elected, also, executive secretary early in 1932. He had been a member since 1895. "Dave" Pye was given the title of "Mr. New York Railroad Club" in the inscription engraved on a gold cup the club presented to him following his retirement from active service last November.



David W. Pye

◆

HARRY W. RENICK, vice-president of the Brake Shoe & Castings division and the Ramapo Ajax division of the American Brake Shoe Company, died on August 24, in Los Angeles, after a month's illness.

PERSONAL MENTION

General

B. L. THOMPSON, superintendent of motive power and car equipment, Manitoba district, of the Canadian National at Winnipeg, Man., has been appointed general superintendent of motive power and car equipment, Atlantic region, with headquarters at Moncton, N. B.

J. J. ELKIN, JR., has been appointed assistant to the general superintendent of motive power and equipment of the Baltimore & Ohio, with heaquarters at Baltimore.

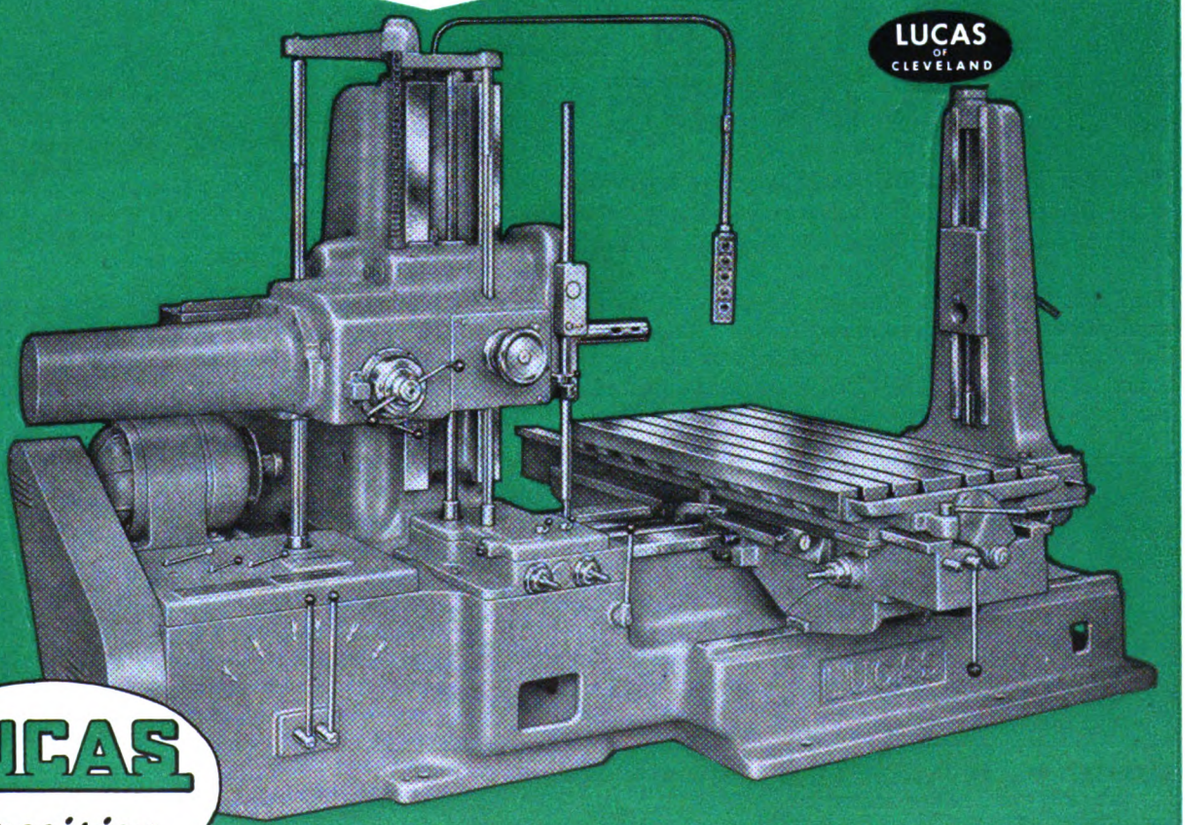
Y. T. GUINN, equipment inspector of the Chesapeake & Ohio, at Chicago, has been appointed Air-brake inspector, at Huntington, W. Va.

ERIC WYNNE, general superintendent of motive power and car equipment, Atlantic region, of the Canadian National, has been appointed general superintendent of motive power and car equipment, Western region, with headquarters at Winnipeg, Man.

These *Big improvements* in boring machines have been Lucas Features *for years*

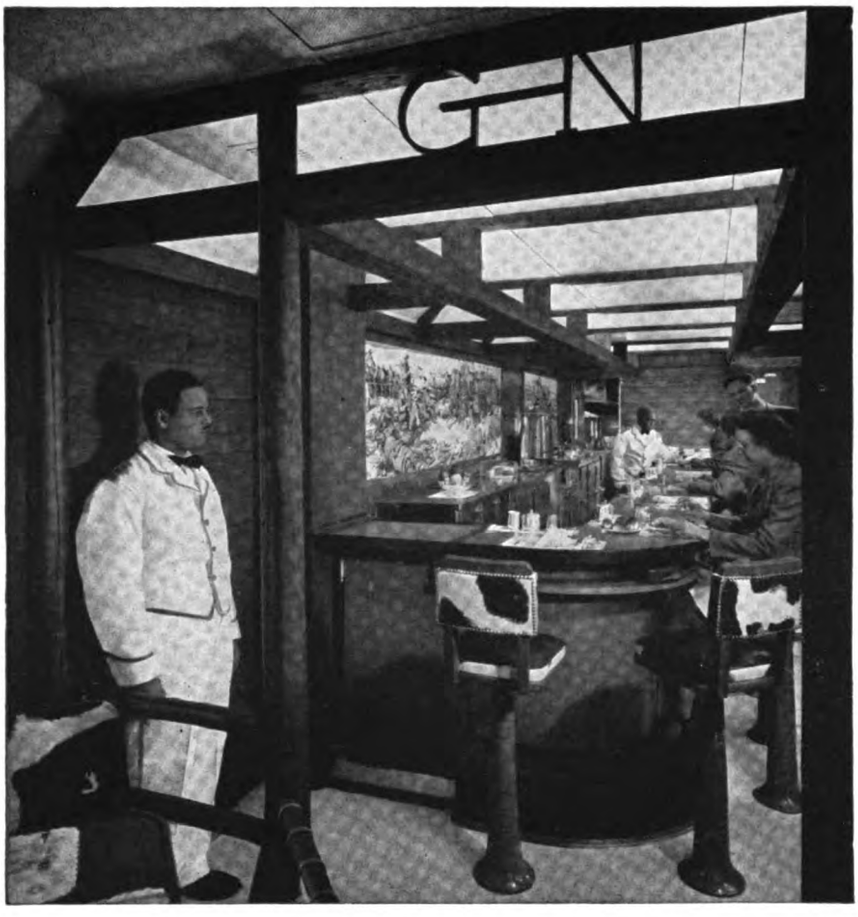
Every advancement of importance to be found in *any* boring mill is obtainable in a Lucas. In many cases Lucas has been years ahead, and some very important developments can be found *only* in Lucas machines. Fifty-one years of specialization on one product has made Lucas the first name in its field.

- Automatic power positioning
- Integrally cast four way beds with 4 point support
- Complete range of feeds and speeds to one spindle
- Pendant control
- Vibrationless V-Belt drive to spindle at high speeds
- Complete line of attachments
- Hardened ways
- Chrome plated lead screws



LUCAS *Precision*

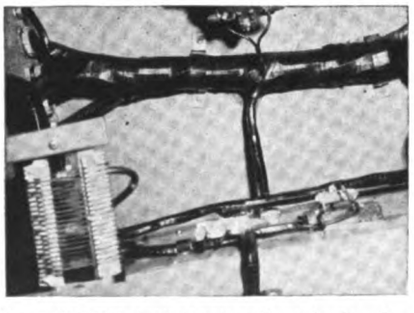
HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO



THERE'S A NEW KIND OF HARNESS ON "THE RANCH"

It's "SCOTCH" No. 33 Electrical Tape—the super-thin, long-lasting plastic tape—that harnesses and insulates all wiring in this famous lounge car, and 74 other cars in Great Northern's new 12 million dollar fleet of trains.

Need a tape that does a big job in small places? Try the tape American Car & Foundry Co. used on the Great Northern's new "Empire Builder"—"SCOTCH" No. 33 Electrical Tape. The smooth plastic backing resists abrasion—oil, water and acid, too. Carries the UL seal. Dielectric strength: 10,000 volts. Sticks at a touch! Order it today!



HARNESSES LIKE THIS electric brake line are only part of the many jobs done with "SCOTCH" No. 33 Electrical Tape on the Great Northern Railway's "Empire Builder."

REG. U. S. PAT. OFF.
SCOTCH
BRAND
Electrical Tape
No. 33

The term "Scotch" and the plaid design are registered trade-marks for the more than 100 pressure-sensitive adhesive tapes made in U.S.A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minn. — also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives.

General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

GUY F. WILES, who has been appointed superintendent of motive power of the Baltimore & Ohio at Baltimore, as announced in the September issue, entered the employ of the road in 1909 as a locomotive cleaner in the Grafton, W. Va., shops. In 1915 he transferred to the Mt. Clare shops, where he became a machinist apprentice. During the next six years he



Guy F. Wiles

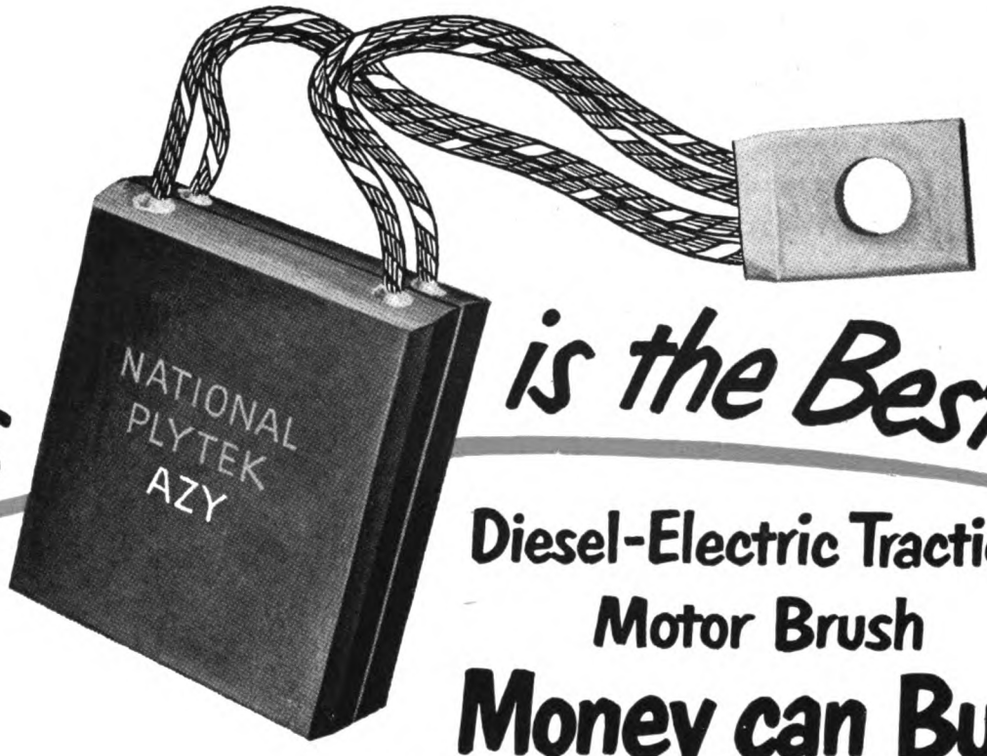
handled a variety of jobs in both the Mt. Clare and Grafton shops and in 1921 became district motive-power inspector at Wheeling, W. Va., and serving successively at Baltimore. In 1937 Mr. Wiles was appointed special inspector at Baltimore; in 1940, supervisor of diesel locomotive operations for the system at Baltimore, and in 1950 assistant to the general superintendent of motive power and equipment.

FREDERICK A. BALDINGER, who has retired as superintendent of motive power of the Baltimore & Ohio at Baltimore, as announced in the September issue, was born at Crestline, Ohio, on August 23, 1881. He entered railroad service there in 1903 with the Pennsylvania, going with the Washington Terminal four years later. He became employed by the B. & O. in December



Frederick A. Baldinger

1913 at the Mt. Clare shops, and later held various supervisory positions at several points. Mr. Baldinger subsequently served as assistant master mechanic, master mechanic, acting district master mechanic and district master mechanic. In 1942 he was appointed general supervisor



This is the Best Diesel-Electric Traction Motor Brush Money can Buy!

Big Statement? You Bet!

BUT WE CAN BACK IT UP! Into the brush illustrated above, National Carbon Company has built plus factors which make it the finest in the world for its purpose — a brush developed especially for diesel-electric motors. Here's why:

- **"NATIONAL" Grade AZY**—proved by millions of service miles to give longest life with excellent commutator condition, plus remarkable freedom from breakage!
- **"NATIONAL" Permanently-Sealed Shunt Connections** do not pull out. Of millions made to date, *not one pull-out* has ever been reported! These Permanently-Sealed Connections also minimize cable fraying through special internal construction.
- **Exclusive Fray-resistant Cable** gives still further protection, with the result that overall brush dependability is assured!

All three outstanding features available in the following "NATIONAL" STANDARDIZED Brushes

NC 24-7215 — 2 x 2¼ x ¾" (⅜-⅜)
NC 24-5620 — 2 x 1¾ x ¾" (⅜-⅜)
NC 24-6420 — 2⅛ x 2 x ⅝" (5/16-5/16)

The terms "National" and "Plytek" and the Silver Strand Cable device are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
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IN CANADA: National Carbon Limited
Montreal, Toronto, Winnipeg

BIDDLE

NUMBER 6 OF A SERIES

Instrument News

HERE'S A "GOOD COMPANIONS" KIT FOR PRACTICAL RAILROAD MEN

...signal engineers and maintenance men



MIDGET MEGGER® INSULATION TESTER

(Ratings to 50 megohms, 500 volts D.C.)

Helps detect dirt, moisture and deterioration in electrical insulation in advance of failure.

MIDGET MEGGER® CIRCUIT TESTING OHMMETER

(Measures .01 ohm up to 200,000 ohms)

Measures conductor resistance of coils, contacts and relays. Does in ohms what the Midget Megger Insulation Tester does in megohms.

TWO HANDY INSTRUMENTS

Both instruments complete with case and leads weigh approximately 6 lbs. Signal engineers and electrical maintenance men say this compact kit of instruments saves so much time and trouble it becomes practically indispensable.

NEW BULLETIN

Bulletin 21-85-X is a recently issued, fileworthy piece describing the "Good Companions" Kit and a third instrument—The new CVM Constant Voltage Type Megger Insulation Tester. Send coupon for this bulletin today.



JAMES G. BIDDLE CO.
1316 Arch St., Philadelphia 7, Pa.

Please mail me your new Bulletin 21-85-X. Thank you.

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JAMES G. BIDDLE CO., 1316 ARCH ST.
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ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

of locomotive maintenance and in March 1943 became superintendent of motive power of the Eastern region.

FRANK X. JONES, supervisor fuel and locomotive operation of the Erie, has been appointed supervisor locomotive operation, with headquarters as before at Cleveland. The position of supervisor fuel and locomotive operation has been abolished.

W. F. DADD has been appointed assistant to the general superintendent of motive power and equipment of the Baltimore & Ohio, at Baltimore.

Car

V. L. MINNICK, general foreman of the Norfolk & Western shop at Williamson, W. Va., has been appointed general foreman at the Shaffers Crossing shop at Roanoke, Va.

GEORGE P. BOWMAN, general foreman at the Shaffers Crossing shop of the Norfolk & Western at Roanoke, Va., has been appointed to fill the newly created position of wheel-shop supervisor in the office of the general superintendent of motive power.

Diesel

A. W. FRASER, assistant road foreman of engines of the Central of New Jersey at Jersey City, N. J., has been appointed supervisor of air brake and diesel performance.

Electrical

GEORGE B. LEWIS has been appointed electrical supervisor, Scranton division, of the Delaware, Lackawanna & Western at Scranton, Pa.

Master Mechanics and Road Foremen

D. BEATH, master mechanic of the Manitoba district of the Canadian Pacific, retired from active duty on August 31.

J. J. RABY has been appointed master mechanic of the Manitoba district of the Canadian Pacific.

P. L. HOFSTETTER, assistant division master mechanic of the Riverside shops of the Baltimore & Ohio at Baltimore, has been appointed master mechanic at Punxsutawney, Pa.

W. P. GILFORD, assistant master mechanic of the Hagerstown division of the Western Maryland, has been appointed master mechanic of the Elkins division, with headquarters at Cumberland, Md.

CLARENCE C. CHURCH, district road foreman and fuel supervisor of the Erie at Marion, Ohio, has retired under the pension rules of the company, after 44 years of service.

FRANK L. VAN SCHAICK, district road foreman and fuel supervisor of the Erie at Port Jervis, N. Y., has been appointed assistant supervisor locomotive operation, with headquarters at Jersey City, N. J. The

(Continued on p. 122)

of new $5,000,000 investment!

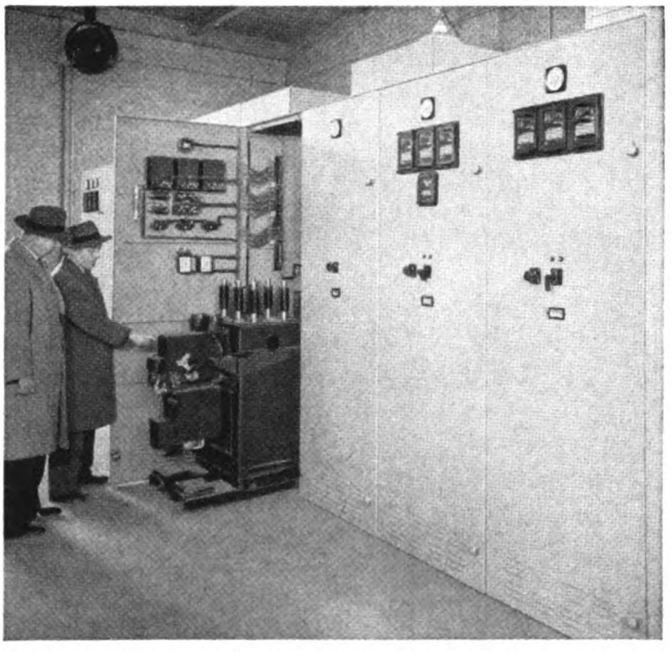
New B&O unloaders move 2000 tons an hour around-the-clock. Continuous power supplied with modern d-c substation and metal-clad switchgear.

Strategic ore from Liberia and South America takes less time to get to the nation's steel producing centers when it is unloaded at the Baltimore and Ohio's new ore facility in the Curtis Bay section of the Port of Baltimore.

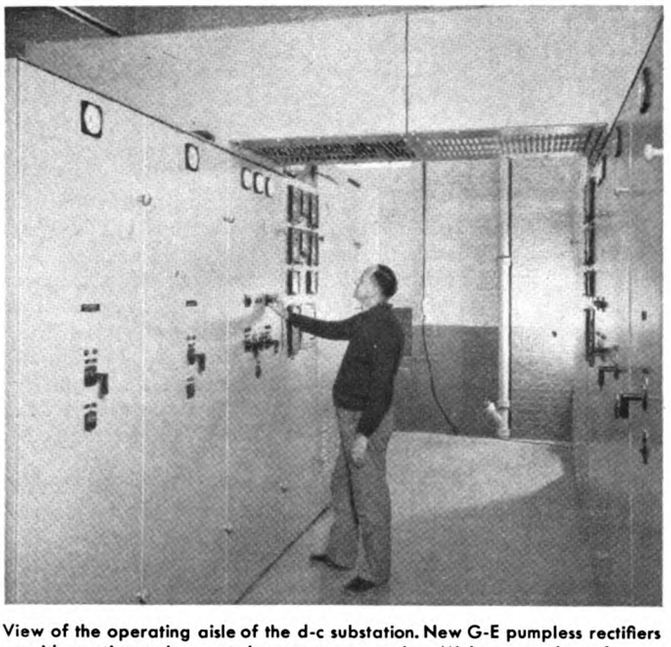
Incorporating the latest improvements in design and equipment, the new ore dock has a working capacity of 2000 tons an hour. The two highly efficient unloaders reduce turn-around time for ore boats and provide an almost continuous stream of ore-laden railroad cars for iron and steel mills. These same cars return to Baltimore loaded with coal, give B & O a two-way pay load for greater efficiency.

Continuous power for 24-hour operation is supplied by modern G-E substations. Two 1000 kw d-c substations supply the main power for the entire installation, while an a-c substation supplies auxiliary power and lighting. G-E metal-clad switchgear provides control and protection for the incoming and outgoing feeders to a-c and d-c load centers.

Forward-looking G-E engineers are ready to apply the knowledge gained from this, and hundreds of other installations, to *your* problems. Investigate today the many advantages of using General Electric switchgear in your plant for efficient, flexible power distribution. Contact your G-E sales representative, or write for bulletin GEA-3083 Metal-clad switchgear. General Electric Company, Schenectady 5, N. Y.



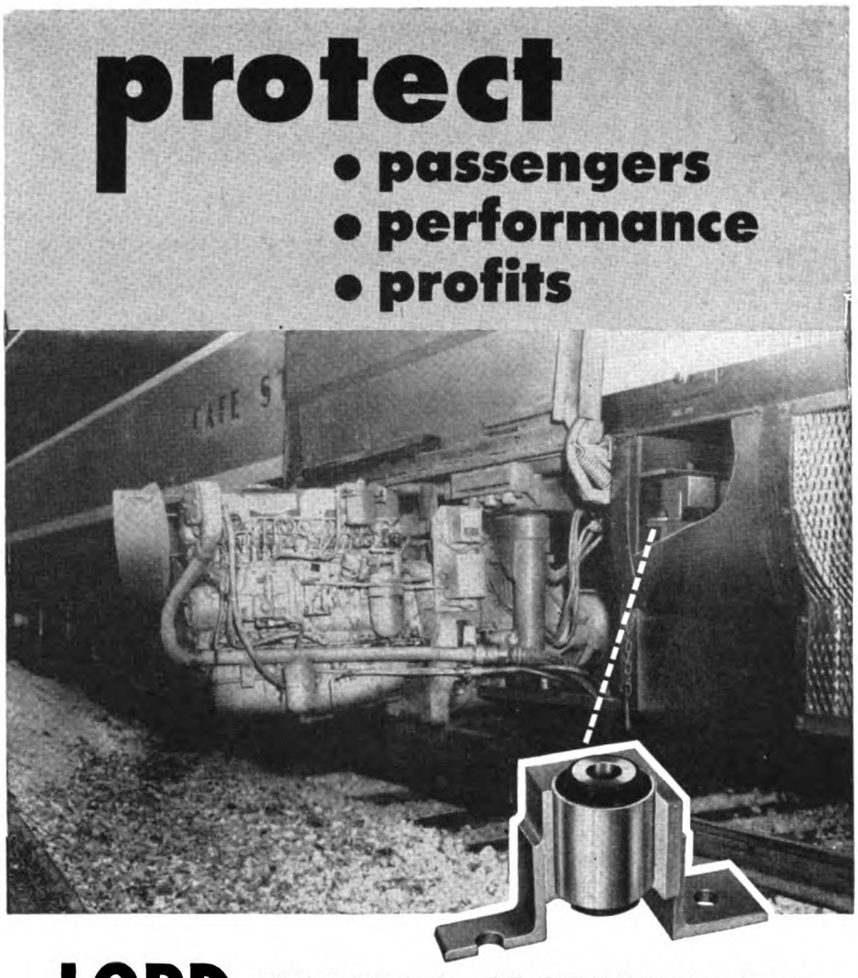
G-E metal-clad switchgear for the 13.2 kv feeders to a-c and d-c substations. All components are metal-enclosed for protection to personnel. Because units are factory-built and arrive ready to install, total installed cost is greatly reduced.



View of the operating aisle of the d-c substation. New G-E pumpless rectifiers provide continuous low-cost d-c power conversion. Minimum number of moving parts reduces maintenance. All parts are easily accessible.

GENERAL ELECTRIC

854-38



LORD VIBRATION-CONTROL MOUNTINGS

LORD Vibration-Control Mountings are standard equipment on the new G. E. Diesel-Electric Undercar Power Plants. They insure pleasure and comfort by protecting passengers from disturbing engine noise and vibration. Performance is so efficient that passengers seldom realize that a power plant is operating beneath the car.

These LORD Mountings also protect the power plant from road shock . . . enabling it to operate smoothly and efficiently without interference. Instruments and automatic controls maintain original accuracy . . . require fewer adjustments . . . are more dependable . . . need less maintenance. Lower maintenance costs mean more profit to the operator.

If vibration is affecting your product's performance—and costing you sales—now is the time to investigate LORD Vibration-Control Mountings. For information, or for assistance in selecting and applying LORD Mountings, write to attention of Product and Sales Engineering Department.

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

Vibration-Control Mountings . . . Bonded-Rubber Parts

position of district road foreman and fuel supervisor has been abolished.

GEORGE R. LYMING, master mechanic of the Elkins division of the Western Maryland at Cumberland, Md., has retired because of ill health, after 38 years of service with the road.

Shop and Enginehouse

W. M. TUCKER, enginehouse foreman of the Norfolk & Western at Williamson, W. Va., has been appointed general foreman at Williamson.

Obituary

CHARLES P. SLACK, electrical supervisor of the Delaware, Lackawanna & Western at Scranton, Pa., died on August 27. Mr. Slack had been in the employ of the Lackawanna for 40 years.

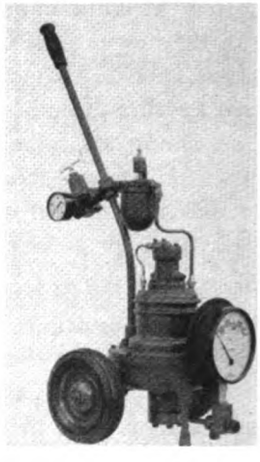
New Devices

(*Continued from p.* 102)

to actuate each of four torches automatically and a master switch for simultaneous control of all torches.

This torch holder can be positioned vertically, 90 deg. left or right parallel to the longitudinal axis of the bar, and with an adaptor can be positioned 90 deg. forward perpendicular to the horizontal axis of the torch bar.

◆



High Pressure Tester

The Intensifier is a new device for utilization where pressure testing is necessary—boilers, piping, compressor cylinders, tanks and similar high pressure vessels, destruction tests in laboratories, etc. A 90 lb. per sq. in. air pressure source will develop up to 23,000 lb. per sq. in. output.

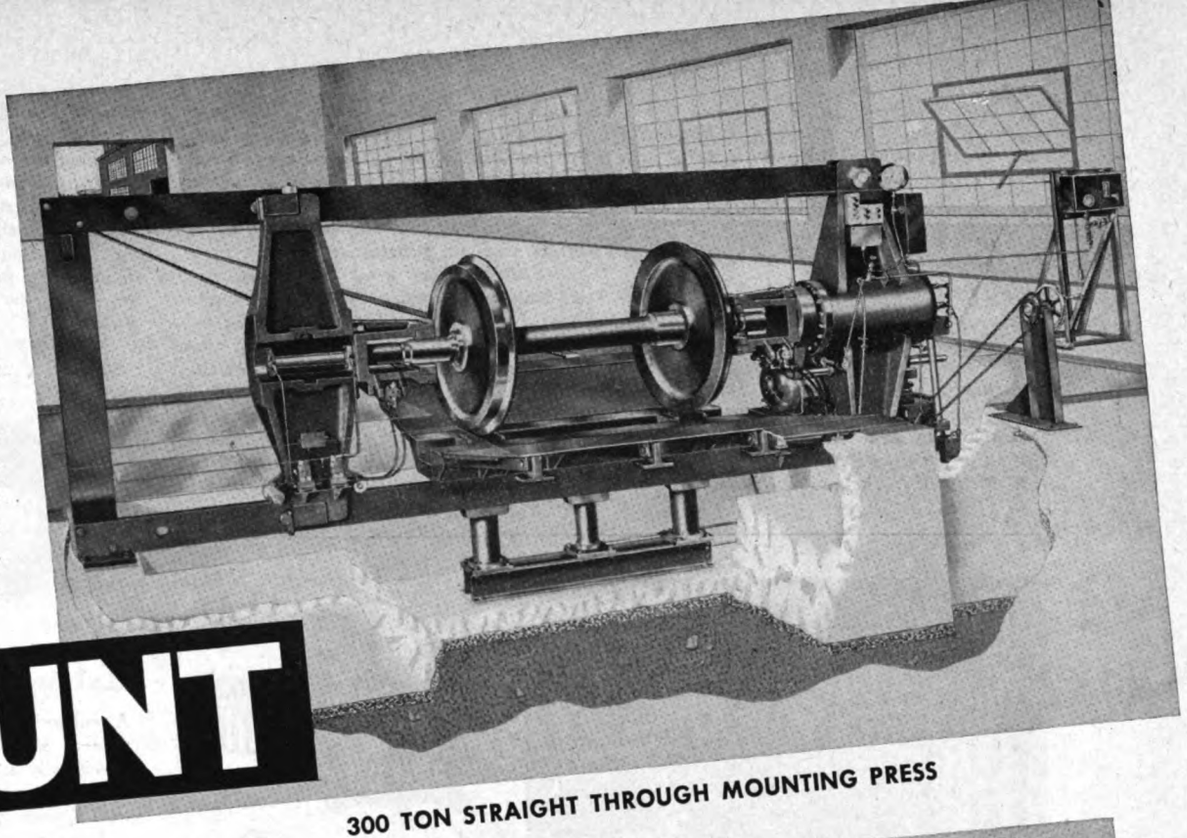
Available in two models, the No. 10 low pressure unit for testing with water has a range from 0 to 10,000 p.s.i. while the No. 23 high pressure device for testing with oil has a range from 0 to 23,000 p.s.i. Both units are developments of The Cooper-Bessemer Corp., Mt. Vernon, Ohio.

Through unique operating principles, they provide complete safety in field and laboratory testing operations where explosive atmospheres are involved.

The unit weighs less than 80 lb. and is

Now, ALL Railroads can put wheel mounting and demounting operations on a real production basis with new, modern W-S Wheel Mounting and Demounting Presses.

Incorporating outstanding design and construction features, these latest developments of W-S Engineers provide the fastest cycle of operation ever attained in this type of equipment, and they handle any type of wheels.



300 TON STRAIGHT THROUGH MOUNTING PRESS

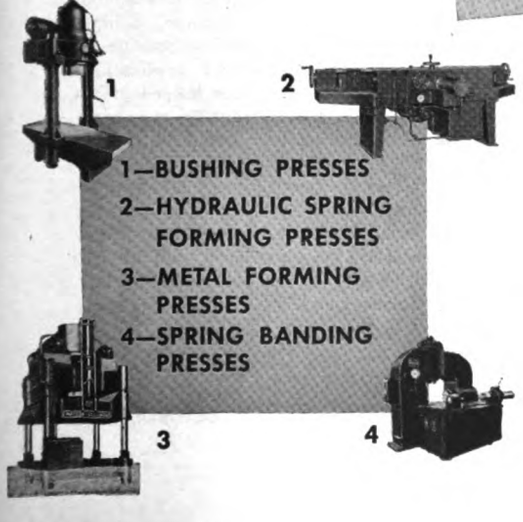
MOUNT and DEMOUNT in Seconds with NEW W-S WHEEL PRESSES

Smashing time records daily, these New Watson-Stillman Speed Presses permit YOU to set your own floor-to-floor speed time—and this is only limited by your loading and unloading facilities.

Get the story today from one of the W-S Representatives listed below.



600 TON STRAIGHT THROUGH DEMOUNTING PRESS



1—BUSHING PRESSES
2—HYDRAULIC SPRING FORMING PRESSES
3—METAL FORMING PRESSES
4—SPRING BANDING PRESSES

WATSON-STILLMAN

HYDRAULIC MACHINERY DIVISION ESTABLISHED 1848

Factory and Main Office: ROSELLE, NEW JERSEY • Branch Office: CHICAGO, ILL.

Manufactured in Canada by CANADIAN VICKERS, Ltd., MONTREAL

REPRESENTATIVES

Chicago 4, Ill. ..... W. R. Walsh	St. Paul 4, Minn. ..... Anderson Machine Tool Co.
Denver 2, Colo. ..... Overgard Machine Tool Co.	San Francisco 5, Calif. ..... Overland Supply Co.
New York 17, N. Y. .... Eastern Railway Supplies, Inc.	Washington 5, D. C. ..... Ralph Payne

9-K-12

delivered ready to go to work as it is equipped with a short length of connecting, high pressure tubing with a ¾ in. 16 TPI coupling.

◆

Copper Ammonium Fluoride Complex

A free-flowing, powdered copper ammonium fluoride complex, soluble in water, is being made available for evaluation purposes by the Pennsylvania Salt Manufacturing Company, 1000 Widener building, Philadelphia 7. The product is offered for use as a termite- and rot-proofing agent for wood and as a mildew-proofing agent for textiles. Studies with a variety of woods indicate that the copper ammonium fluoride complex, when dissolved in water and diluted to 0.5 per cent copper, exhibits excellent penetration characteristics. After drying, the wood shows resistance to leaching superior to similar samples treated with zinc chloride or copper sulfate. Stake tests run over a period of more than five years indicate that protection conferred by copper ammonium fluoride is greater than that obtained by treatment with zinc chloride.

The dry formulation represents an improvement over liquid copper ammonium fluoride solutions in that dilutions as low as 0.04 per cent copper may be made without the necessity of adding ammonium hydroxide in order to maintain stability.

In application, wood may be sprayed, soaked, brushed or pressure impregnated with solution prepared from the copper ammonium fluoride.

◆



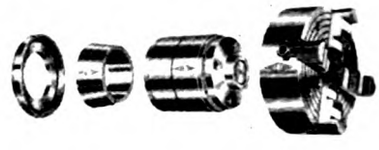
Rubber Frame Goggle

A rubber-frame goggle, designed to provide a gas-tight seal and recommended specifically for gas, fume and smoke hazards, is announced by the American Optical Company, Southbridge, Mass.

The 701 goggle is constructed without any ventilation slots in the rubber frame to prevent infiltration of air. When the goggle is perfectly fitted, a gas-tight seal results. The headband of the goggle enters slots in the outer goggle frame and not through a slit in the lens. Also, screw-headed bolts on the front of the goggle are made of non-corroding stainless steel.

The goggle may be obtained in combination with American Optical's R2000 or R5000 respirators. These combinations can be supplied permanently riveted together or as separate units.

◆

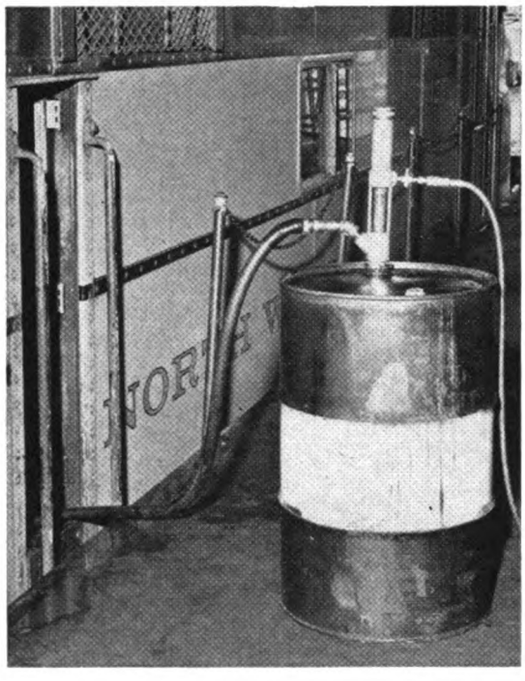


Outside Spindle Type Center

A Red-E anti-friction superaccurate center that mounts to an independent chuck is the latest development of the Ready Tool Company, 554 Iranistan avenue, Bridgeport, Conn. It was designed to provide an accurate center for special applications such as for turning irregular shaped pieces and for accurate alignment to the headstock when turning uncentered work such as forgings, castings, crankshafts and other pieces.

The anti-friction type center is mounted to the outside spindle of the tailstock and held securely by a hardened and ground tapered bushing. It can be made to fit any size or make chuck.

(*Continued on p.* 128)





WILKINSON

High Speed Diesel Lube Oil Transfer Pump

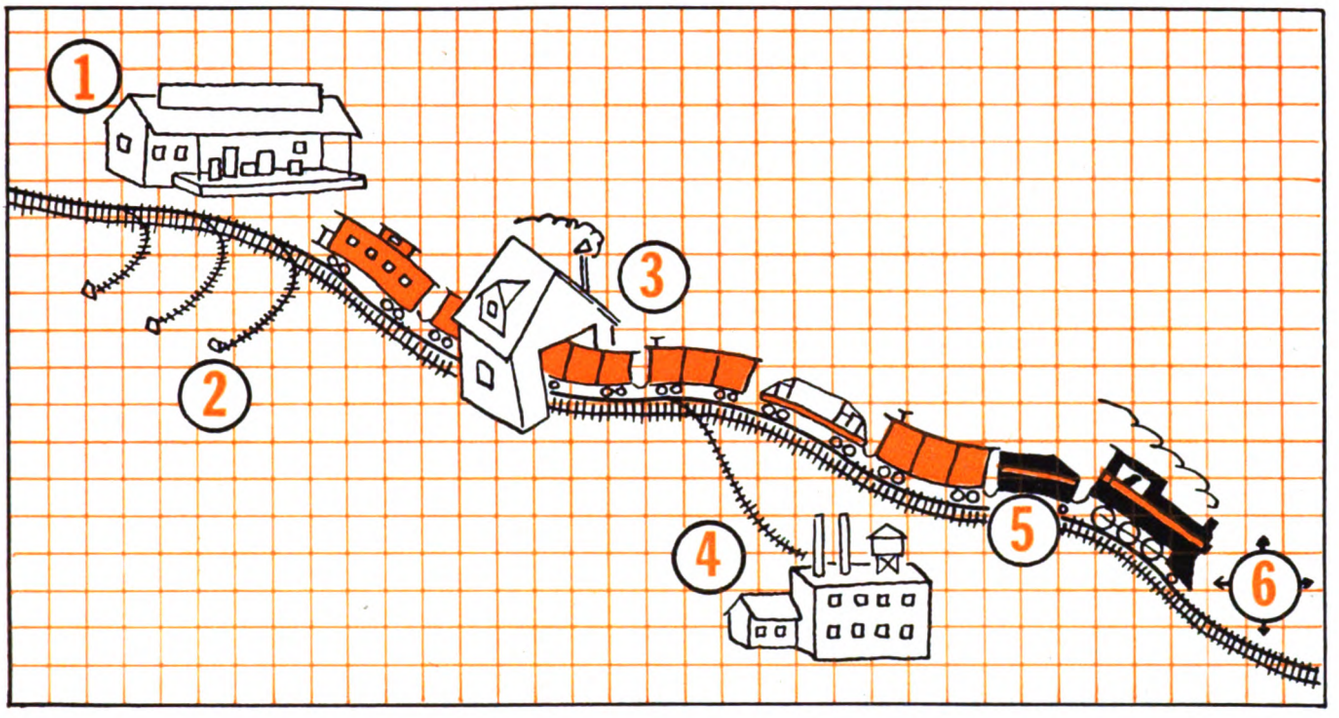
REDUCE your Diesel lube oil handling time by more than 41% and eliminate oil spillage. Use the WILKINSON light-weight air-operated transfer pump. Only weighs 15 lbs. and **no air enters barrel.**

You can pump a 55-gal. barrel S.A.E. #40 lube oil in 5 minutes with only one man.

Can furnish ready-to-use,—package consisting of WILKINSON Transfer Pump, 35 feet of ¾" oil hose, and automatic shut-off valve.

HUDSON 3-5221
WILKINSON EQUIPMENT & SUPPLY CORP.
6958 SOUTH WENTWORTH AVENUE
CHICAGO 21, ILLINOIS

Operating costs come down *all along the line*...with "Roller Freight"



1 AT TERMINALS—Man-hours needed for journal inspection are reduced 90% when freight trains are mounted on Timken® tapered roller bearings!

2 IN THE YARDS—"Roller Freight" makes more cars available because cars can get where they're going faster and spend less time in repair shops. Humping operations cannot displace parts of the Timken bearings.

3 IN THE SHOP—There are fewer repair jobs needed on draft gear and other parts when freight cars roll on Timken bearings. Timken bearings make it possible to eliminate impact damage from serial starting.

4 AT DESTINATIONS—Damage claims are reduced because "Roller Freight" makes possible smoother starts and stops. Timken bearings cut starting resistance 88%.

5 ON THE ROAD—"Roller Freight" practically eliminates "hot boxes" and the resulting expenses and delays. Timken roller bearings minimize friction. And there's no waste to "grab".

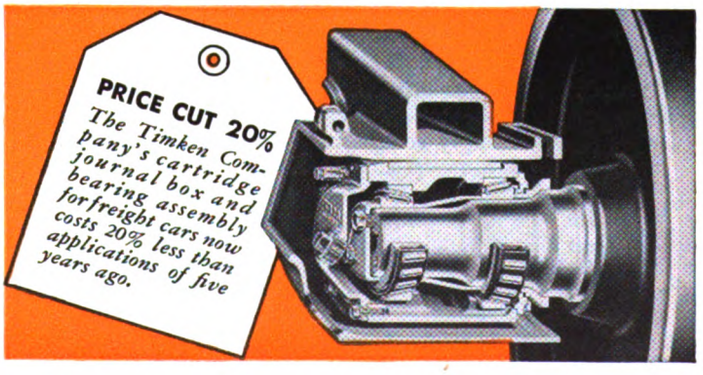
6 ANYWHERE—Timken bearings reduce starting friction to a minimum. You can schedule full-length trains even in cold weather!

MORE BUSINESS, TOO! "Roller Freight" not only cuts your operating costs. It also gives you a big, competitive talking point with shippers in your bid for a greater share of tomorrow's freight tonnage. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

STOP



RUST

Available in many colors, aluminum and white.

RUST-OLEUM can help you control rust—to cut your maintenance costs—and to avoid needless rust losses. It stops rust effectively—and prolongs the useful life of rustable metal so that costly replacements can be deferred years longer than previously could be expected.

Railroads find RUST-OLEUM the practical answer to many rust problems. Its tough, pliable film gives excellent protection to rolling stock, bridges, tanks, metal buildings, signal equipment and other properties.

CUT YOUR MAINTENANCE COST

Rescue metal that has already started to rust. RUST-OLEUM can be applied *even* over metal already rusted —usually without sandblasting or the use of chemical cleaners. Simply scrape and wire-brush to remove rust scale and loose rust. Then apply RUST-OLEUM by brush, dip, or spray. It stops the rust, and promptly dries to a firm, pliable, rust resistant protective coating.



Write for your copy of the RUST-OLEUM Railroad Catalog



RUST-OLEUM CORPORATION

2590 Oakton Street **EVANSTON, ILLINOIS**

Air-Pressurized Fire Extinguisher

Now on the market is a completely new 1 qt. air-pressurized fire extinguisher, designed and introduced by the American-La France-Foamite Corp., Elmira, N. Y. This unit discharges vaporizing liquid fluid for extinguishing both flammable liquid and electrical type fires such as class B and C fires.

The extinguisher, called Alfco Pressurized Fire-Gun, carries the inspection and approval label of Underwriters' Laboratories.

The device aims and operates like a gun, with trigger-quick action, and hits the fire target accurately with no unnecessary loss of liquid. It requires no pumping. Anyone can operate it, and with one hand.

It is an ideal unit for protecting autos, trucks, trailers, airplanes, street and railroad cars, motor boats, garages, and electrical equipment and will stop small oil and grease fires from becoming big blazes.

The extinguisher is easily recharged by simply pouring in more vaporizing fluid. Pressure can be applied with any standard air chuck as commonly used in gasoline service stations.

◆



Lightweight Dust Hood

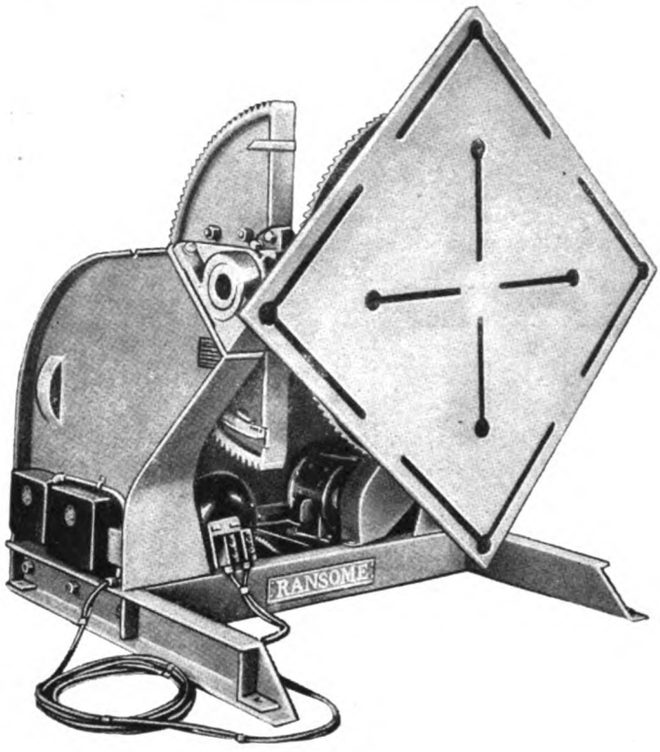
A new type lightweight dust hood, announced by Willson Products, Inc., Reading, Pa., has easily interchangeable frames and windows which make possible the use of one hood either with or without a respirator. The hood itself is of lightweight cotton duck, and a close but comfortable fit is obtained by adjustable neck and underarm web straps.

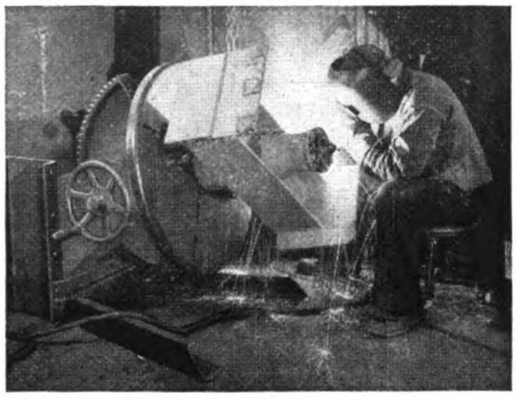
Extra-large windows of .040-in. nonflammable acetate sheeting, which provide ample vision for extra safety, can be replaced without removing the frame. The frames of semi-rigid fibre can be easily removed by means of snap fasteners for cleaning when necessary.

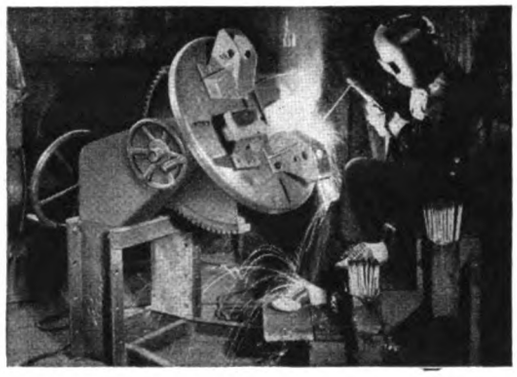
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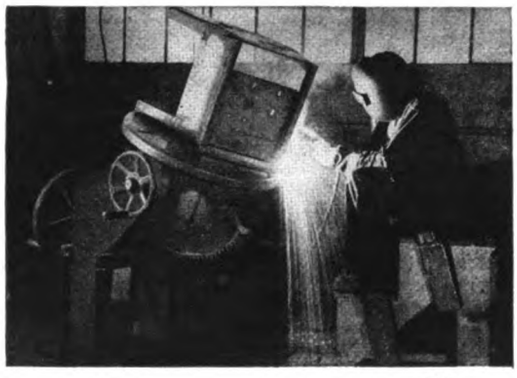
Lots of Different Pieces or Lots Alike...

THIS POSITIONER PAYS OFF









Y.1.2

in more production . . . better welds . . . less rod waste

The universal table top makes the Worthington-Ransome Welding Positioner as profitable on *job* work as it is in mass production.

Those "T" slots make the table adaptable to any shape of work piece and a wide range of sizes. No special jigs or fixtures needed.

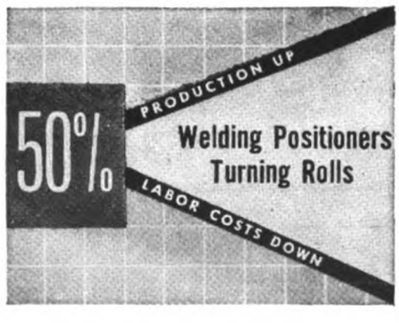
Whether you produce "thousands alike" or "every one different", benefit from *increased arc-time* with Worthington-Ransome Welding Positioners. With just one set-up, the work is clamped to the table top. Then push-button controls or simple hand cranks do the work of tilting or rotating into any position convenient for economical downhand welding. Your welder can continuously weld without costly time and labor wasted in frequent rehandling of the work.

Result—up to 50% more footage, *better* welds (using higher current and heavier rods), less welding rod waste.

Welding positioner capacities from 100 lb to 30 tons. Also: turning rolls from 3 to 150 tons, stationary or self-propelled.

Write Worthington Pump and Machinery Corporation, Dunellen, New Jersey, for bulletins or additional information.

WORTHINGTON



With the respirator window and frame assembly, the hood will accommodate respirators which provide a high degree of protection against dusts and low concentrations of common industrial gases and vapors.

◆

Plastic Cover Plate

A new plastic cover plate affording greater protection for welding helmet windows is announced by the American Optical Company, Southbridge, Mass. The plate, made from special thermosetting plastic, is clear, hard and almost colorless, possessing surfaces comparable in smoothness, lustre and chemical resistance to polished plate glass. It is more resistant to pitting than glass, will not discolor under ordinary welding conditions, and will not peel, crack, blister or shrink in service. The plate, it is said, will last longer than glass and will give up to 1,000 hrs. of service.

◆

Spotwelding Control System

A new control system that extends electrode life 20 to 30 times when spotwelding aluminum with ordinary single-phase a.c. welders has been developed by the Reynolds Metals Co., Louisville 1, Ky.

Known as Slope Control, it is in effect a variable resistor connected in series with the heat control potentiometer to reduce welding current during the first few cycles of the weld, allowing it to build up gradually to maximum welding current.

The control cuts the total amount of heat produced in the welding tip to less than one sixth normal temperature. This in turn means that sticking and deposition of aluminum on the electrode tips are greatly reduced because deposition of aluminum is directly proportional to the temperature at point of contact.

With this control, the aluminum softens at the tip-work interface and allows the tip to sink into the work slightly before the full welding current is applied. When maximum welding current is reached, there is a considerable portion of the tip surface contacting the work and current is distributed over this entire area so that high current densities do not occur. This, in turn, prevents sticking, the major obstacle to quality work.

◆





Functional Design Fire Detector

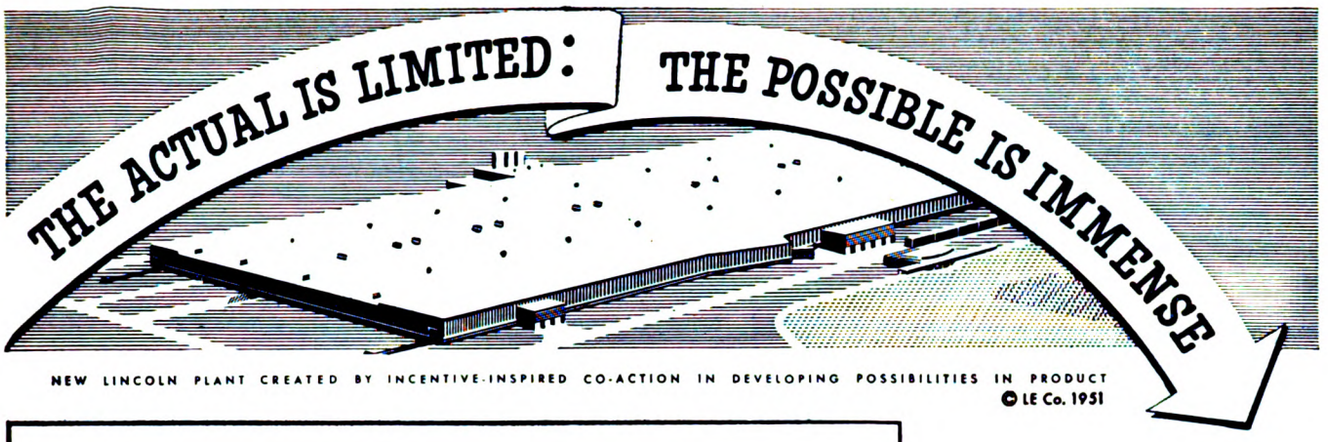
Employing a new principle of fire detection described as "Rate Compensation," Fenwal, Inc., Ashland, Mass., has just marketed a fire detector.

The fixture fits snugly and unobtrusively against the ceiling and is mounted in a curved steel case. It can be installed within new or existing alarm systems, or can be made to actuate an extinguishing system directly.

Called the Detect-A-Fire, the unit has the property of giving an alarm precisely at the moment the surrounding air reaches the temperature for which the device is set. For example, if fire warning is desired at 140 deg. F., the device is pre-set for this point.

Its construction is unique in that it employs a stainless steel "sensing" tube which is always in direct contact with the air. Hermetically sealed within the tube are silver electrical contacts. Expansion of the tube with heating of the surrounding air brings the contacts directly together to sound an alarm or to operate extinguishing equipment. Units are available for either normally open or normally closed circuits.

Temperature settings up to 325 deg. F. may be had. An area as large as 625 square feet can be protected by a single unit.



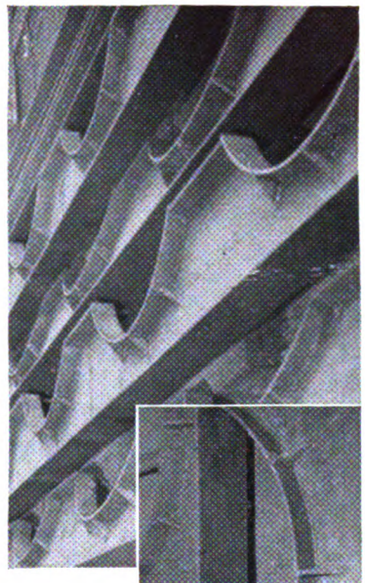
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

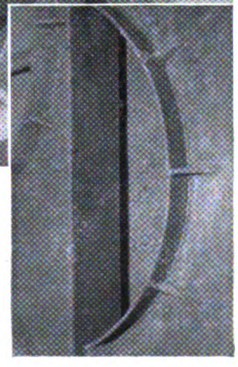
© LE Co. 1951

CONVERTS STANDARD CARS FOR SPECIAL DUTY

EMERGENCY production orders for converting standard rolling equipment to suit specialized needs are being handled with greater dispatch through arc welding. By properly applying the economies of welded steel construction, car shops today are effecting such modifications with less material and with fewer man-hours. The resulting construction is also found to be stronger, more rugged to withstand the severe impact and loading requirements of modern railroading.

Latest welding techniques for simplifying and speeding your maintenance repairs are available on request. Write for them.





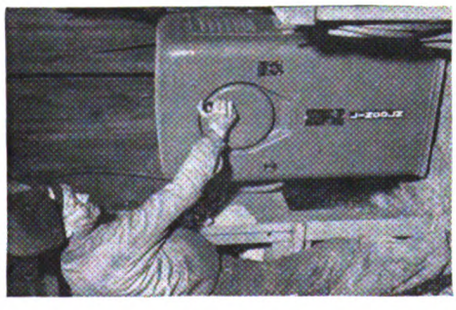


Fig. 3. Versatile "Fleetwelder" *300 amp Lincoln AC arc welder with "Arc-Booster." Built to handle a wide range of car shop repairs.*

Fig. 4. Wheel Transportation Car *is made up by adding individual supports fabricated from plate. Components are flame cut, formed to shape and fillet welded with Lincoln "Fleetweld 11" electrode.*

SAVES CRITICAL MATERIALS



Fig. 1. Reclaims friction draft casing. *Cracked and worn malleable iron casting is recovered by building up bearing surfaces with Lincoln "Ferroweld" electrode.*

AND BUILDS STRONGER UNITS



Fig. 2. Replacement spring saddle *is fabricated from 3 pieces of plate . . . saves on delays, saves on costs.*

MODIFIES CAR CONSTRUCTION AT LOWER COST

For further information about arc welding procedures and equipment, write The Lincoln Electric Railway Sales Co., 11 Public Square, Cleveland 13, Ohio. Railroad representatives of

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO

NEW IDEAL FLEXIBLE ABRASIVE



- Cleans Commutators
- Gives Burnished Finish to Commutators After Grinding

The perfect tool for use following grinding or using a regular Resurfacer on the commutator. Made of a fine grain abrasive material held together by a flexible bond. It's gentle, fast action quickly removes surface imperfections with minimum cutting . . . Used as a commutator cleaner it quickly removes high resistance film, dirt and grease. Cleans like an eraser and generates very little dust—wears down slowly without "gumming" or dusting. Does not affect the face of the brush or cause filling of commutator slots. Non-conductive and non-loading — can be safely used with motors or generators operating. *Will not scratch or score commutators or rings . . .* Very easy to use. Just hold it against the face of the turning commutator or slip ring. FIVE SIZES — Order by Catalog number.



82-001	3/8 x 1/2 x 5
82-002	3/8 x 3/4 x 5
82-003	3/8 x 1 x 5
82-004	1 x 2 x 5
82-005	1 x 4 x 5

MAIL COUPON for this FREE 40-p. HANDBOOK

Authoritative . . . . Fully Illustrated!

IDEAL PRODUCTS ARE SOLD THROUGH LEADING DISTRIBUTORS



IDEAL INDUSTRIES, INC. (IDEAL)
1563 Park Avenue, Sycamore, Illinois

Please send your free handbook and further information on

☐ Flexible abrasive ☐ Precision grinders
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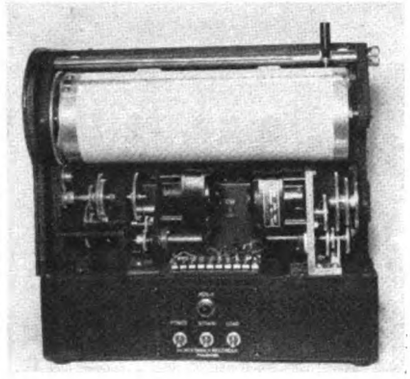
NAME.....
COMPANY.....
ADDRESS.....
CITY.....ZONE.....STATE.....

Work pieces are infinitely adjustable from 8 to 96 r.p.m., utilizing a 3 hp. d.c. motor for the work drive. The headstock may be swivelled 90 deg. for face grinding operations.

Dual controls are available so that the machine may be operated either from the front or from the rear, depending on the shape of the work piece. The hydraulic traverse is adjustable to any desired speed between 3 to 130 in. per minute. The swivel table is adjustable for grinding tapered work pieces.

Reservoirs for coolant, hydraulic oil and lubricating oil are all in the bed casting. Electrical motors and control are raised to permit easy servicing of these parts. This machine is also available as a plain grinder for single purpose high production operations.

◆

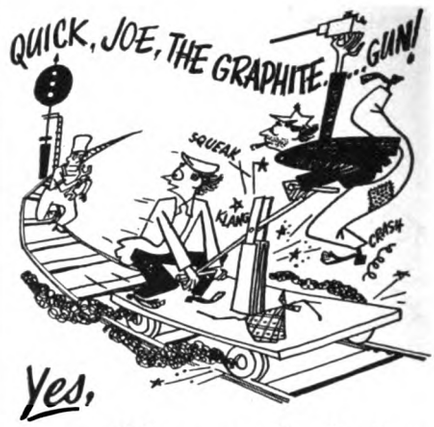


Self-Contained Strip-Chart Recorder

A portable strip-chart recorder of the X-Y type for plotting automatically on rectangular coordinates the simultaneous relationship between any two variables that can be made to actuate Microformers, is announced by Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

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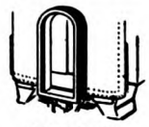
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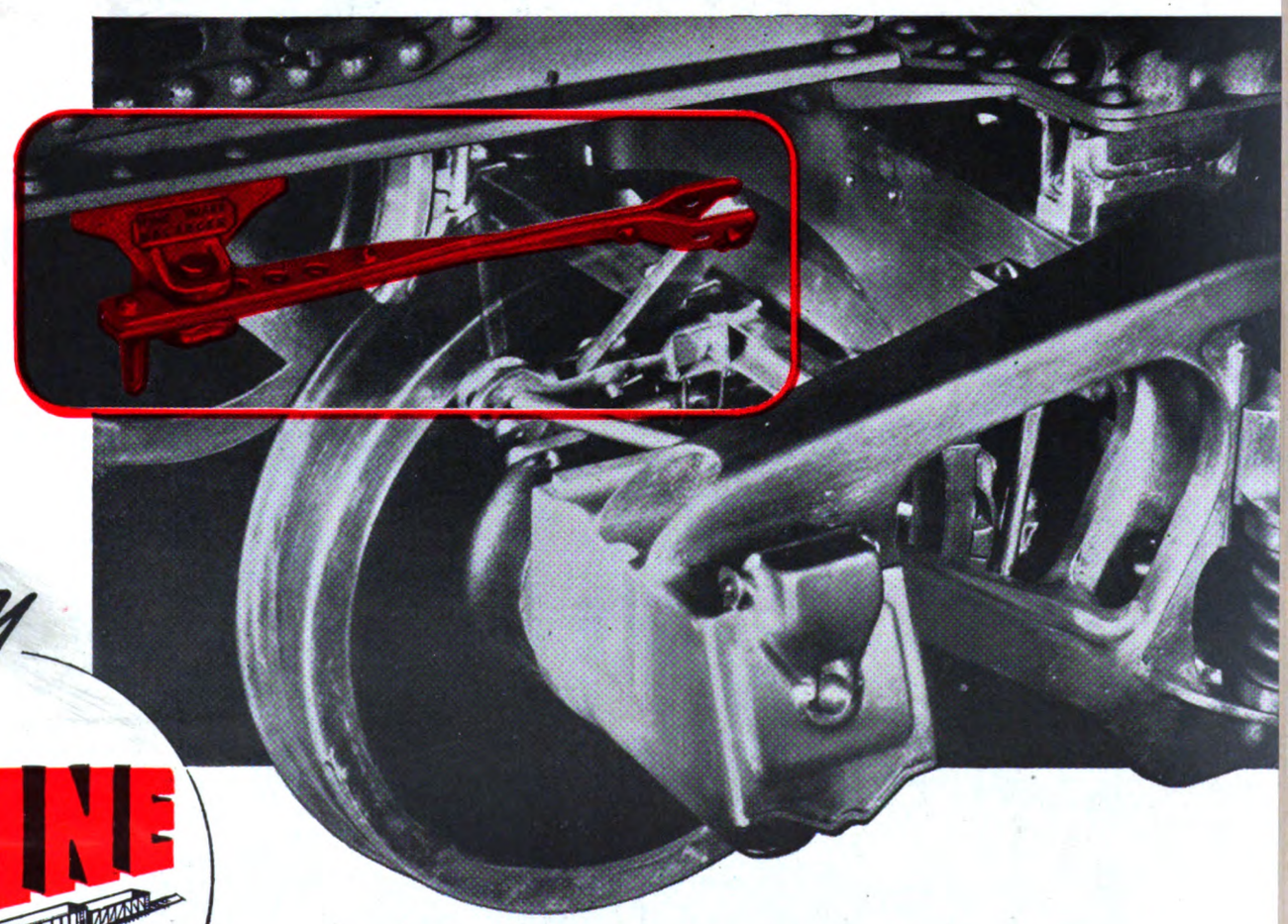
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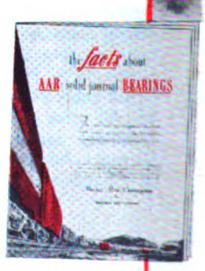
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Impressions from the Coordinated Meetings

Greater Responsibilities

When an organization continues to grow year after year as the Locomotive Maintenance Officers' Association has there must be a reason; you can't charge it all off to the enthusiasm of its officers or to the persistent effort of its membership committee. Since 1939 this group has grown steadily from less than a hundred "old faithful" members to over 3,000. It has reflected the recognition on the part of hundreds of mechanical-department men of the need for an agency through the medium of which the knowledge of the technique in maintaining a new type of locomotive could be disseminated to thousands of departmental employees as rapidly as possible. It has served this purpose well and its success has been deserved.

Its very size, though, should be a warning. Things that are built rapidly and built big sometimes become top heavy. There are signs that the L.M.O.A. should reappraise its functions and reexplore its responsibilities to the industry. For the past five or six years the organization has done a good job of developing reports that have inspired, even incited, discussion on a variety of diesel power problems that definitely needed talking about. There are now broader problems that need to be approached with caution and understanding. Two of these are the questions of personnel training and the broad question of the design of diesel maintenance facilities. If some organization with the influence of L.M.O.A. doesn't soon lead the way in the matter of the relation of the younger employees to the railroads that employ them, whether it be apprentices, mechanics or the younger supervisors, it may not be long before the roads won't have any personnel training problem; the labor organizations may take care of it for them. The personnel committee could do a real job in 1952 and 1953 if they have the understanding to approach this subject with broadness of mind and the courage to attack it honestly.

As to diesel maintenance facilities, F. K. Mitchell's paper "We Pause To Plan," which appeared in the October issue, points out the real job that the L.M.O.A. should do—namely, set up a shop engineering committee that will consider this subject from a comprehensive engineering standpoint instead of dealing with it from the bolt-and-nut standpoint. There isn't a subject that the railroad industry needs information on today any more than on the matter of intelligent planning for future servicing and repair facilities, nor is there one that is liable to involve the possibilities for greater losses by way of exorbitant maintenance costs if the planning isn't intelligently done.

C.D.O.A. Meeting

The Car Department Officers Association now boasts well over 1,000 members and it is encouraging to note what a large proportion of the membership from all parts of the country were in attendance. At several of the sessions standing room only was available around the walls of a room seating about 400.

In a program of outstanding committee reports, it is difficult and somewhat hazardous to select any for special comment, but probably little exception will be taken to the following general statements: The report on wheel shop practices was comprehensive, authoritative and of real value to any railroad interested in building a new wheel shop or improving present wheel shop operations. The report on car lubrication was an intensely practical statement of causes and remedies for current hot-box difficulties; the discussion suggested that some of the major causes are beyond the control of car men.

The report on conditioning freight cars for higher commodity classification was notable for the amount of information included about what must be done to improve the condition of various classes of freight cars. The report in its entirety is a text book for car department apprentices and new employees in basic freight-car requirements.

The report on painting presented to this association for the first time essential information regarding how passenger car cleaning and painting materials are tested to determine essential requirements for best results. The discussion of this report was extensive, controversial in spots, generally pertinent and will add materially to the value of the association's year book.

Looking to the Future

With steam locomotives being rapidly replaced as the work horse of the railroads the Master Boiler Makers' Association is meeting the situation by turning to diesel locomotive work in which the boiler makers' experience can be utilized to advantage by the railroads. The Association is focusing its attention on the steam generators and the fuel and water tanks.

A number of the association's members have general supervision of welding as well as boiler work. This combination of duties is a natural one because the development of railroad welding has been associated closely with boiler fabrication and maintenance. The association will devote more of its program in the future to welding and it is contemplating presenting recommendations on the welding of diesel parts at its annual meeting next year.

The major interest in this year's annual meeting reports was shown in the one on the washing and testing of steam generators. Next year some definite recommendations on this work will be presented with the emphasis placed on the elimination of coil failures. The water-supply tanks will also receive attention, particularly with respect to design changes that will facilitate inspection and washing.

Steam locomotives were not neglected. One report dealt with the current replacement of riveted boiler shells by welded shells. Another covered the savings that can be obtained by the use of anti-foaming compounds which permit carrying a higher percentage of solids.

The Master Boiler Makers' Association will celebrate its "Golden Aniversary" next year and is looking forward to continuing to serve the railroads as faithfully and by "pulling no punches" as it has since it was founded in 1902.

Growing Pains

Discussions of Electrical Section reports disclosed a membership which was greatly concerned about a difficult and growing situation and which is making an earnest effort to get it under control.

It was stated, for example, that air conditioning of passenger cars doubled electrical maintenance requirements, while the advent of the diesel locomotive has increased it many times. In the locomotive field this has created a need for electricians which apparently cannot be met by hiring them from the outside. There are few available who have had any railroad experience, and outside industry, with the increasing demand for defense, is willing to pay rates which are higher than those paid by the railroads. The net result is an enormous demand for training and education. It has become necessary to give special training to men who have no electrical background and whose jobs may be in jeopardy because of the decline of the steam locomotive.

In the car department increased duties have gone beyond the capacity of existing forces. It frequently becomes necessary to let a piece of equipment which is due for inspection go over to the next trip with the hope and, perhaps, a prayer that it will get by. It appeared to be the concensus of opinion that cars with failed equipment be held out of service, that work done be followed up by close inspection, that equipment performance records be improved, and that more young men be brought into the service and given special training.

Diesels and Air Brakes

The changeover to diesel power has not occurred without affecting even the air-brake man. New problems for him to solve have arisen both in regard to learning to operate and maintain the brake equipment installed on diesel power and in deciding which of two general types to apply on what types of locomotives. The latter was one of the "hot" subjects of this year's Air Brake Association meeting.

There is no great difference of opinion on whether to apply 24-RL equipment or one of the No. 6 equipments if the locomotive in question has a clear cut assignment. Road locomotives get the former and switchers get the latter. But what of the road switcher? What determines whether the added cost of the 24-RL can be justified? Is it a question of the portion of time the locomotive spends in road service as compared to that spent switching? Or is it a question of the type of road assignments made, high speed or drag? How about other traffic operating on the same stretch of rail, and what about the run itself? What about the improved No. 6 type arrangement described in one of the papers? Will such modifications make the cheaper and simpler-to-maintain No. 6 suitable where it would otherwise be questionable? If 24-RL is applied extensively in place of No. 6, where will we get the additional men to inspect and maintain it, requiring, as it does, several times as long as the No. 6?

Not all these questions were, or could, of course, be given a final answer. But no one who attended the 1951 Air Brake Association meeting could have come away without having his thinking stimulated and his outlook broadened.

Joint Sessions

One of the advantages of holding simultaneous meetings of the six Coordinated Associations in the same place is the opportunity it affords for two associations to get together in joint sessions for discussions of subjects which are of mutual interest. Two such sessions were held during the meetings at Chicago in September. In one the Air Brake Association joined the Railway Fuel and Traveling Engineers' Association in the discussion of a report on train handling. In the other, the Electrical Sections joined with the Locomotive Maintenance Officers' in the discussion of the Electrical Section report on Automotive and Electric Rolling Stock and of Fay Thomas' paper on wheel slip on diesel-electric locomotives. Each session was confined to one hour.

There are sufficient elements of controversy in the subject of train handling so that, once the discussion is started, the problem is not to keep it going, but to bring it to an effective conclusion. The joint Air-Brake-Traveling Engineers' session over ran its time by more than half an hour and it was too late to permit the Air Brake Association to resume its own program.

Following completion of the program of the joint Electrical Section-Locomotive Maintenance Officers' session the Electrical Section adjourned and the Locomotive Maintenance Officers continued with its own program, on which was a report on cleaning and testing diesel-electric motors and generators. Certainly this is a subject of great interest to many members of the Electrical Section, and one the discussion of which would have benefitted by their participation. The usefulness of joint sessions probably can best be realized if all reports for them are the work of carefully selected joint committees and if each program covers an entire half-day session.

Air Brake Men Discuss a Wide Variety of Problems



F. C. Wenk
President
(General mechanical instructor, A. C. L.)



K. E. Carey
First Vice-Pres
(General Air-Brake instructor, Penn.)



R. F. Thomas
Second Vice-Pres.
(General Air-Brake instructor, C. P. R.)



C. V. Miller
Third Vice-Pres.
(General supervisor Air brakes, N.Y.C. & St. L.)



L. Wilcox
Secretary-Treasurer

The outstanding themes at the air brake meetings were the development of information for the 24-RL equipment and the maintenance of freight car brakes

THE Air Brake Association held its 43rd annual meeting—and its fifth as a member of the Coordinated Railroad Mechanical Associations—at the Hotel Sherman in Chicago from September 17 through 19. The meeting was presided over by K. E. Carey, first vice-president, in the absence of President Fred C. Wenk, who was unable to attend due to illness.

Prominent among the subjects dealt with was the inspection and maintenance of all diesel locomotive brake equipment, and possible modifications of switching locomotive brake equipments to render them suitable certain road services. Two papers covered 24-RL locomotive brake equipment, and one described the No. 6 switcher brake equipment and outlined some features that could be added to it to permit limited use on road switchers. At several times there were lively and informative discussions as to whether road switchers should be equipped with the modified No. 6 equipment or whether 24-RL should be installed despite its greater cost.

Freight and passenger brake problems received a full share of attention. A detailed study of the effect of air leakage on the former, and one of the maintenance of clasp brakes on the latter were presented and discussed on the second day.

The convention attendees also heard a progress report by a committee set up by the Air Brake Association to gather information on standardizing the location and application of diesel brake equipment.

Repairs were dealt with extensively, both in papers devoted exclusively to maintenance and as parts of other papers. Attention was called to the fact that more, not fewer, men are needed for proper maintenance of air brakes, and for the allied function of inspection, if we expect to continue to run long trains. More men were felt to be needed if the current tendency to add new features and complications to brake equipment continues.

Several members at times expressed the thought that certain pieces of information presented at the convention would do the maximum amount of good only if these could be made known to the car man and if he could be sold on the merits. It was said that there are plenty of rules and regulations, including those of the A.A.R. The problem is to get compliance.

24-RL Locomotive Brake Equipment Troubles and Remedies

It has previously been stated that it is not good practice to make repairs or adjustments to air brake devices while on a locomotive because of the possibility of dirt entering the valve parts. The repair of portions should be made in the Air Brake Room whenever possible for cleanliness and for later testing to insure that they will function properly when applied to the locomotive. It has been found advisable to have cleaned and tested portions readily available as replacement.

Before attempting to locate any trouble, check the points listed below:

1. Electric brake switch in "ON" position.
2. Motor generator set, if used, operating properly.
3. Battery voltage within the tolerable limits.
4. Jumper cable between units connected and in serviceable condition.
5. Position of hand brake (applied or released).
6. Auxiliary reservoir and main reservoir pressure up to standard and air compressors operating poperly.
7. Accuracy of air gages.

After the above points have been checked, the outline that follows will assist in locating and remedying trouble.

I. With the electro-pneumatic brake applied to full or any intermediate pressure, a wide fluctuation of the straight air pipe pressure may be caused by one of the following reasons:
   - A. Self-lapping portion of the automatic brake valve defective.
     1. High packing cup friction causing the binding and erratic opening and closing of the discharge valve.
     2. Lack of lubrication causing excessively high friction between moving parts of self-lapping unit.
     3. Leakage of the inlet or discharge valves.
     4. Defective or broken piston spring: *Remedy—Replace self-lapping portion.*
   - B. Master Controller defective because of:
     1. Improper adjustment of contacts.
     2. Corroded or worn contacts.
     3. Straight air pipe or control diaphragm ruptured.
     4. Leakage past check valve causing overcasting.
     5. Restricted choke allowing overcasting of master controller: *Remedy—Replace master controller.*

II. With the electro-pneumatic brake applied to full or any intermediate pressure, excessive pumping of the master controller may be caused by:
   - A. Straight air pipe leakage.
   - B. Excessive range in self-lapping unit of automatic brake valve together with control pipe leakage.
   - C. Improper gap between contacts of master controller.
   - D. Leakage at exhaust of 21-B magnet will result in drop in straight air pipe pressure: *Remedy—Replace 21-B magnet.*
   - E. Interruption of current to 21-B release magnet which will cause drop in straight air pipe pressure: *Remedy—Repair fault in circuit.*

III. Excessive arcing of master controller contacts may be caused by:
   - A. Defective arc suppressing condensers of master controller.
   - B. Excessive current demand for electric brake circuits resulting from:
     1. Shorted 21-B magnet coils.
     2. Shorts in train line wiring.
     3. Too many cars in train. *Remedy—Eliminate shorts in electric brake circuits or reduce length of train.*

IV. Incorrect electric brake operation may be due to 2-B magnets being defective for one or more of the following reasons:
   - A. Leakage at 21-B magnet exhaust port when brakes are applied due to:
     1. No current to exhaust magnet of 21-B resulting in exhaust valve not closing.
     2. Shorted or burned-out exhaust magnet coil.
     3. Worn or leaking exhaust valve seat.
     4. 21-B magnet pipe bracket gasket leakage.
     5. Broken or missing exhaust magnet armature stem.
     6. Exhaust magnet armature stem stuck in release position.
   - B. Leakage at 21-B magnet when brakes are released due to:
     1. Worn or leaking application valve seat.
     2. Application magnet armature stem stuck in applied position.
     3. Pipe bracket gasket leakage.
   - C. Failure of straight air pipe pressure to build up when electro-pneumatic application is made may be due to:
     1. No current to application magnet of 21-B magnet.
     2. Application magnet coil of 21-B magnet burned out or shorted.
     3. Broken or missing 21-B application magnet stem.
     4. 21-B application magnet armature stem stuck in release application.
     5. Protective valve of 21-B magnet closed because of either low auxiliary reservoir pressure or defective protection valve.
     6. Clogged or restricted strainer or pipe bracket choke of 21-B magnet.
   - D. Failure of brakes to release after electro-pneumatic application may be due to:
     1. Release magnet valve of 21-B magnet stuck closed when straight air pipe cutout cocks ar closed. *Remedy—Open straight air pipe cutout cocks between units and replace 21-B magnet.*
     2. Circuit to release magnet of 21-B not broken because of:
        - a. Grounds between release wire and B+ wire of other equipment.
        - b. Failure of master controller release contact to open.
     3. Hand brake not released.
     4. Automatic brake set.
     5. Incorrect reading on brake cylinder gage.

V. Improper, or failure to build up, brake cylinder pressure during an electro-pneumatic application may be caused by:
   - A. Excessive straight air pipe, cutout cock, hose or gasket leakage.
   - B. S-40-D Type independent brake valve handle in lock-down position rather than release position.
   - C. D-24 control valve, independent application and release portion not operating properly due to check valve leakage.
   - D. Brake cylinder gage defective.
   - E. Straight air pipe pressure fails to build up. *Remedy—Check operation of 21-B magnets, master controller and check for straight air pipe leakage.*
   - F. Excessive brake cylinder leakage.
   - G. Brake cylinder cutout cock closed.

Speed Governor Operating Tests

The speed governor control used in conjunction with the electro-pneumatic brake consists of an axle generator, relay panel and an FS-1864 relay valve including a magnet portion and K-3 switch portion. Failure of the speed governor equipment to operate properly may be due to one or more of the following:

I. Panel light fails to burn at proper time caused by either a burned-out light or the directional relays in relay panel being inoperative.

II. The speed governor equipment may not cause the brake cylinder pressure to increase or decrease in accordance with speed due to:
   A. Repeater relays fail to respond because of burned-out coils or corroded contacts.
   B. Wiring from axle generator to relay panel defective.
   C. Generator voltage output not in accordance with standard for various axle speeds.
   D. Improper adjustment of high, medium and low speed relay resistors in relay panel.
   E. Magnet portion of FS-1864 relay valve fails to respond to relay operation because of:
      1. Ruptured diaphragm in relay portion.
      2. Broken or stuck high, medium or low speed manet coil armature stem.
      3. High, medium or low speed blowdown chokes restricted.
      4. Magnets fail to respond when speed governor panel relays operate due to:
         a. Battery switch being cut out.
         b. K-3 switch fails to close power circuit to magnets.
         c. Wiring from relay panel to magnets defective.
         d. Incorrect voltage coil use in relay valve magnets.

The report was a presentation of a committee of the St. Louis Air Brake Club, of which E. W. Erisman of the Wabash is chairman.

Discussion

Considerable differences of opinion were expressed regarding where and by whom the master controller may be adjusted. One road operated electro-pneumatic brakes successfully for five years without even having a test panel. Others said that it deserves the best of maintenance and test equipment. As to adjusting the master controller, one road did not allow it to be fixed in place as it was felt that engine crews would eventually be tampering with it. Another road does not permit engine crews to touch it, but has competent mechanics adjust it in place, and thinks that if a mechanic cannot do this job in place he needs education.

Improved No. 6 Type Brake Equipment for Diesel Switching Locomotives

The major changes in the latest No. 6 type equipments as compared to the 14-EL include the substitution of a self-lapping type independent brake valve for the previous manual lapping type, addition of a sander operating valve, and a bell ringer valve to the brake valve assembly, and a more compact grouping of the cab devices to eliminate much of the exposed air brake piping. Experience with self-lapping type of brake valves on other types of locomotives and in other uses indicated that the independent brake function for switching purposes would be improved by its use. The self-lapping brake valve does not require a manual movement of the handle to lap position after a movement to a brake applying position. The position of the handle through its range of movement determines the degree of brake application. As the self-lapping brake valve embodies the pressure regulating means, previously provided by a reducing valve, the latter device is not required with any of these No. 6 type equipments.

The extension of the diesel switcher into branch line and transfer service, and the development of the road switcher or general purpose locomotive, has resulted in adding certain features to the air brake equipment. The most significant of these are the provision for multiple-unit operation, and the incorporation of such safety features as service safety control, overspeed protection, and automatic train stop, features formerly associated with modern road locomotive equipments. These additions were made, not to make the No. 6 equipments suitable for road service, but to enhance the safety and broaden the scope of the locomotive in general yard switching service.

Until very recently, multiple-unit control in these equipments has been obtained by the addition of a filling piece and transfer valve located between the reservoir and operating portion of the standard 6-KR distributing valve, thus converting the latter to the well-known 6-DKR type. The transfer valve is not a new device, as it was included in the original 14-EL equipment on many electric locomotives. As used with the 6-DKR assembly, it relays the performance of both the automatic and independent brake systems from the leading unit to the trailing unit through a connecting pipe line designated as the "Equalizing Pipe." The transfer valve is positioned pneumatically on the lead unit to charge the equalizing pipe from the brake cylinder, and on the trailing unit to connect the equalizing pipe to the application portion of its distributing valve, thereby duplicating changes of brake cylinder pressure on the lead unit in the brake cylinders of the trailing unit. The positioning of the transfer valve is controlled by the proper positioning of the three-position double-heading cock of 14-EL, 6-BL and 6-SL equipment, and by a separate cock located in the transfer valve operating pipe of 6-DS equipment when multiple-unit control only is involved. Because of the extended length of the double unit locomotive, brake pipe vent valves are required to insure propagation of emergency brake action both to and from the train.

Addition of special control apparatus to the basic automatic brake systems of the 14-EL and No. 6 type brake equipment for the purpose of obtaining safety control, overspeed control, and train stop brake applications, has presented a rather awkward problem which has been inadequately solved until the recent development of a new form of brake application valve known as the N-1-A. Heretofore, the requirements for these more elaborate controls have been relatively so infrequent on switchers, that it has been expedient to employ older brake application valves such as the B-2, B-3 and F types, all of which are limited to producing an emergency brake application. The N-1-A produces a service brake application, and consists of a single pipe bracket to which are mounted the service application portion, the equalizing piston valve portion, the safety control relayair portion, the brake pipe cutoff valve portion, and the double heading cock. Inclusion of all these portions in a single valve unit reduces the number of individual pipes to a minimum.

For the purpose of overspeed control or train stop type of train control, an electro-pneumatic valve is connected to the No. 10 pipe of the N-1-A brake application valve, and for safety control including the suppression feature, a foot operated valve is connected to the No. 12 pipe. Exhaust of air pressure normally confined in these pipes, either through the foot valve or through the electro-pneumatic valve, causes the application valve portion to assume its applied position. Since this latter portion must function automatically to reduce equalizing reservoir pressure at a service rate when it moves to applied position, the equalizing piston valve must be located where it can be operated by both this valve and the automatic brake valve. This is accomplished by moving the equalizing piston valve function from the brake valve to the N-1-A brake application valve. Thus, the automatic brake valve portion, so arranged, is designated the type "X." It includes a rotary valve having a "lock-over" port which prevents the return of the brake application valve portion to its normal release position until after the brake valve handle has been moved to Lap position. Also, the equalizing piston has been removed from it and a properly ported blanking plate applied between the rotary valve seat and equalizing piston valve portions. The "X" type

automatic brake valve portions are not interchangeable as units with those used on steam locomotives or diesel switchers on which the special automatic features provided by the N-1-A valve are not involved. Also, with this special equipment an emergency relay valve is required to insure obtaining a brake valve initiated emergency brake application regardless of the position of either the application and brake pipe cutoff portions of the N-1-A valve or of the pipe cutout cock.

When the many features of the N-1-A brake application valve and related devices are added to those of multiple-unit control, it is readily apparent that the service expected from locomotives so equipped can demand far more in brake apparatus than was ever contemplated in the simple automatic and independent brake systems of the original smaller yard switchers. It is not surprising, therefore, that a demand has been created for every possible simplification of the equipment and piping required for the varying intended services. This demand, together with recent requests for still additional provisions in the No. 6 type diesel switcher equipments for an adequate dynamic brake interlock and better protection against loss of air in the event of a break-in-two of connected locomotive units, has resulted in a modification of the 6-SL and 6-BL equipments which presumably will become the future standard wherever these types of equipments are employed.

[The remainder of this paper described in detail the following newer elements of these future standard arrangements: The No. 6-BL and No. 6-SL equipments arranged for multiple-unit operation with H-6-B relayair valve; the No. 6-BL and No. 6-SL equipments arranged for both multiple-unit operation and dynamic interlock with H-6-A relayair valve; and break-in-two protection as afforded by H-6-A and H-6-B relayair units. It also urged that 24-RL equipment be used on all diesels intended for road service. A motion was made during the discussion but defeated in a close vote, that this recommendation be stricken from the report. Those favoring this recommendation felt that the No. 6 equipment modified as described in the report would perform many services satisfactorily and it was a good deal cheaper than 24-RL.—Editor] The report was a presentation of the Manhattan Air Brake Club.

The Maintenance and Testing of Decelostat Equipment

In yard testing, the decelostat equipment should be tested before each trip, but not less frequently than once each week, in accordance with the test codes using the test device. The car air brakes should be applied, and the test device should be applied to the decelostat as outlined in the preliminary instructions of Test Code T-1632-O. It is important that the decelostat be tested in each direction by rotating the dial housing slowly and noting that the leaf spring tension of the test device is sufficient to cause the decelostat equipment to operate.

If the test device is not available, a suitable test of the equipment can be made by removing the external exhaust plug and rotating the decelostat inertia wheel with the finger to cause the decelostat equipment to operate. It is important to rotate the inertia wheel in both directions to insure proper decelostat operation regardless of direction of car travel. In addition, the inertia wheel should be held in the tripped position a sufficient period of time to determine that the broken pipe feature is functioning. This may be determined by noting that the brakes reapply. This "finger test" will determine if the decelostat equipment is functioning, but not if it operates within the proper limit of deceleration rates as is shown by the test device.

If, during either of the above tests, proper functioning is not obtained on one axle, the decelostat on that axle should be replaced. If proper function is not obtained on either axle, the proper portion of the B-3 decelostat valve should be replaced. If the equipment does not function properly in cold weather, the vents should be checked for ice.

When a decelostat or decelostat valve is found to be defective, it should be removed and taken to the air brake room for the proper repairs and testing. Present practice recommends annual cleaning and testing of all decelostat equipment; however, tests are being conducted to determine if this period of time can be extended.

Shop Maintenance

When portions have been removed to the air brake room, dismantle in accordance with Instruction Leaflet 2612-1, of June 1949. After pilot valve body portions have been removed and before further dismantling, a visual inspection of all parts should be made to detect wear or excessive lost motion. At this time, the cam should be checked for wear, and, if any is visible, check to determine if it is within allowable limits as follows: .010 in. cam wear is considered the maximum allowable, and this wear can be measured at the pull rod, .010 in. cam wear being the equivalent of .005 in. travel of the pull rod. This travel can be measured by using gage No. 107237 and suitable feeler gages. The space between the gage and the pull rod is measured with the feelers when the cam roller is on the flat portion of the cam. The cam roller is then moved to the worn portion of the cam, and the clearance between pull rod and gage is again measured. The difference between these measurements should not exceed .005 in. The cam roller should be examined to ascertain whether it is equipped with steel bushings in the fulcrum pin holes. If it is not so equipped, or if there is any sign of wear in these holes, the lever should be scrapped and a new one substituted. It is important that the decelostat be completely disassembled so that all parts may be examined and checked.

All parts should be thoroughly cleaned as outlined in Instruction Leaflet 2612-1. The sealed ball bearings should not be cleaned in any solvent, as these bearings are lubricated for the life of the mechanism and any cleaning solvent would have a harmful effect. These bearings should be cleaned externally by wiping with a clean cloth, and blowing with an air jet. Bearings that are not sealed can be cleaned in a suitable solvent, blown dry with an air jet, and later repacked with an approved lubricant. The chamber should be completely filled by using a grease gun at the tapped hole after removing the plug. All bearings should be thoroughly checked by hand rotation to determine if there are any indications of wear or damage.

Lubrication and Assembly

Only approved lubricants should be used. The rubber seated check valves should be treated with triple valve dry graphite. The check valves should be placed in a box with dry graphite and shaken, then removed, and the excess graphite lightly wiped off on a piece of chamois. The threads of choke plugs and other removable plugs should be coated lightly with a compound consisting of one part graphite and two parts SAE-20 oil.

Parts of the decelostat that should not be re-used include the shaft lock washers, the fulcrum lock washers, diaphragm follower packing ring, and all lock wires. Several roads have had good results using a steel cotter pin in place of the annealed brass fulcrum lock wire, as the annealed brass wires have been known to shear off due to improper installation or other causes. Do not use a drift punch to position the fulcrum pin after the lock wire or cotter pin has been placed. This has been known to shear off the lock wire without being apparent to the workmen and resulting in subsequent failure of the decelostat.

The equipment should be assembled in strict accordance with Instruction Leaflet 2612-1. After assembly of the individual portion, the gages shown on Page 18 of the instruction pamphlet should be used. When gaging the decelostat housing portion, use Gage No. 107237. The correct pull rod height may be adjusted by the use of .010 in. shim. In some instances, the cam roller

shaft has been found to wear where it makes contact with the *cam* lever pull rod. Rather than scrapping the cam roller shaft, additional service can sometimes be obtained by rotating it 180 deg. so that an entirely new wearing surface is presented; this has, in some cases, eliminated the need for a shaft shim. When gaging the pilot valve portion, use gage 107238. Note that the *pilot* valve is in good condition and that the end is not flattened or peened over. This condition could result in improper operation even though the portion can be made to pass the gage. If the pilot valve tip is peened over, the valve may hang up at some time during operation and remain in the open position due to binding *in* the pilot valve seat in the open position.

The decelostat may then be removed to the test rack for necessary testing.

The B-3 decelostat valves should be dismantled, cleaned and assembled according to instructions in Instruction Leaflet 2612-1. Follow the same general method in cleaning and inspection and and lubrication as in the P-3. When reassembling, the diaphragm follower packing ring should be renewed.

The B-3 decolostat valve release portion should be tested on the AB test rack using Test Code T-1583-O, and the AB-88 test plate combination. The protection valve portion should be tested on the AB test rack using Test Specification T-1585-O, and the AB-85 test plate combination. The P-3 decelostat pilot valve portion should be tested on the AB test rack using Test Specification T-1517-O, and the AB-92 test plate combination. When testing the complete P-3 decelostat, the equipment shown on Page 24 of Instruction Leaflet 2612-1 is necessary for a sensitivity test. A torque wrench with a range of 0-80 inch-ounces is required to determine if the decelostat operates within the proper force range. The torque wrench is applied to the drive shaft at the rear of the decelostat.

The report was prepared by the committee on approved maintenance practices, of which F. W. Dell, G.T.W., is chairman.

Discussion

The discussion centered chiefly about the possibility of lengthening the present 1-year internal between cleaning the decelostat. One speaker felt that one year was long enough based on conditions found today at this annual cleaning; a second felt that while there are a number of improvements that have been made, a year is enough right now, but he hopes to increase this period so that it will coincide with the cleaning period of the brakes. A third is approaching the time when his decelostats will all go 24 months; the mechanical decelostats on his road are pretty well beat up as they approach two year's service due to the pounding from the box even though they are rubber-mounted. He thinks that electric decelostats should go 24 months. It was advocated that the ball bearing in the housing should be at least a hand-pressed fit as the bearing turns in the housing, causing wear of the housing and giving excessive clearance. In reply to this, another member said that ball bearing manufacturers recommend that the outer races be allowed to creep slightly so that given vibration will not pound the parts at the same place all the time. At present there is from .0001-in. interference to .001-in. clearance, but you can have several thousandths clearance without hurting anything. If the housing does wear too much it can be bored and rebushed. A bushing is not included in the new equipment as it would increase the cost more than felt justified for the few times it would be required.

Standardization of Air Brake Equipment on Diesel-Electric Locomotives

The studies made by this committee on standardization of air brake devices on diesel- and turbo-electric locomotives included functions of brake parts, additions of desirable elements, and the proper application and location of parts. Recommendations made and approved by this association are then to be processed through the Brake and Brake Equipment Committee of the A.A.R. so that the present A.A.R. Committee on Diesel Standardization will have available for its deliberations with builders, concrete evidence of what the best air brake minds deem essential for diesel air brake equipment.

A canvass was made by each member of the committee of many roads now using diesels and an expression was received, based on experience had with 4,765 diesel switchers, 1,581 road switchers, 4,199 road freight units, 1,329 road passenger units and 582 electric locomotives. The entire range of available diesel air brake schedules are represented in the above numbers of units in general, satisfaction expressed with the schedules as received, it being indicated from the replies received that the brake schedule should be selected in accordance with the use to which the locomotive is to be put.

The majority of those canvassed recommended 6-BL or 6-SL equipment for switching and road switch service, and 24-RL for road freight and passenger service.

For the most part, it was indicated that considerable improvement should be made in the location of the various air brake parts. Parts are now all too frequently located so that adjustments are difficult to make, inspections are impossible and removal for maintenance purposes are difficult of accomplishment and definitely wastes valuable man hours. For example, in many instances, air compressors are so located as to make inspection, orifice test and removal extremely time wasting and difficult. Air gauges are too small. In other instances brake valve pipe brackets have been so located as to hinder removal of portions at periodic inspection times and make adjustments of valves contained thereon difficult. Cutout cocks at the rear of A units and at both ends of B units should be so located outside of the end sill that their positions can be easily checked.

At least two manufacturers have taken definite steps to render complete cooperation and make corrective designs which we feel will materially improve the situation.

It is clearly indicated to this committee that dissatisfaction is widespread due to inadequate radiation systems. This Association has at the last two conventions received through the Manhattan Air Brake Club two papers on this subject covering several years study and containing definite recommendations for proper and adequate radiation.

In addition to such items, replies received by the committee specifically state that cab arrangements are in many instances subject to improvement. For example: Rotary valves should be so located near the control station so that they cannot be used as a footrest, but that the position of the operating handle can be checked from the engineman's normal position. It would materially improve the condition if the four positions of the Rotary valve were plainly marked with not less than $\frac{3}{8}$-in. raised letters on the escutcheon plate.

The foregoing represents a brief resume of the committee's efforts to date and by no means exhausts the possibilities of further investigation.

The following items are recommended for transmittal to the A.A.R. Brake and Brake Equipment Committee for further handling with the A.A.R. Committee on Locomotive Construction, and in the judgment of this committee should be required from all builders:

1. Radiation systems to be in accordance with data contained in the proceedings of the 41st and 42nd Annual Convention of the Air Brake Association, and so arranged to obtain maximum benefit of available cooling effect.

2. Diesel switching and road switching units are to be equipped with 6-BL or 6-SL brake equipment except where road switch units are regularly used in multiple for road service; then it is felt such units should have 24-RL brake equipment.

3. Road freight and passenger units should have 24-RL brake equipment.

4. All parts of any schedule of brake equipment shall be so

located that required inspections and maintenance procedures can be made without undue waste of effort and time.

The report was submitted by a committee of which C. E. Miller, New York Central, is chairman.

Discussion

Because it takes longer to work No. 6 equipments as special features are added, and about three times as long to work 24-RL equipment as 6 ET, the practice of adding extras should be stopped until more men are furnished to maintain them. The need for the P.C. switch was questioned as it is not used on electric locomotives; the engineer has to close off the throttle himself after applying the brakes.

There was some controversy as to whether 24-RL equipment should be restricted to road locomotives only or should also be used on road switchers and those switching locomotives used occasionally in multiple with 24-RL equipped with locomotives. One example given was a GP-7 which might have to take the place of a B unit in an A-B-A combination. Under such conditions the GP-7 should have 24-RL equipment, whereas if it were only used singly the extra cost of $600 to $800 for 24-RL would not be justified. One member thought that the purpose of the standardization committee should be the proper location of the equipment and it should not concern itself with recommending any particular type of brake equipment for any service. A committee member replied that they had received such a wealth of good information from many lines that they merely summarized this thinking.

Effects of Air Leakage in Freight Trains

The study of the factors involved in the characteristics of the flow and leakage of air in air brake systems must be made under laboratory conditions for accuracy and consistency in the analysis of results. It is this use of stationary test racks representing the complete pneumatic air brake system of freight cars assembled in trains as long as 150 cars that accounts for apparent discrepancies between technical studies and the less accurate observations obtained on freight trains in actual service. Conditions on the two available freight train test racks of the air brake companies can be controlled so that all extraneous factors are eliminated or kept uniform. Measuring devices for pressure and air flow can be kept in accurate calibration and observations precisely coordinated in all parts of the train. It would therefore be expected that results on actual trains in service could be predicted from tests run under laboratory conditions; but that some discrepancies would be caused by factors which appear in actual service and which must be accepted as found. To understand what they are and how they affect brake performance is the first important step toward elimination of those which are seriously adverse.

The A.A.R. test for brake pipe leakage of a train, as determined during the outbound terminal tests, or if a single car as determined by the single car code of tests, requires that a brake application be made; and after the reduction has reached 15 p.s.i. from the original charged pressure, that the further fall in brake pipe pressure be observed for a period of one minute. This defines brake pipe leakage not in terms of the quantity of air lost to the atmosphere, but in terms (p.s.i. per min.) of the significant result of such loss. The actual amount of air (cu. ft. of free air per min.) leaking from the brake pipe will depend upon the number of cars in the train. If each car should uniformly have an amount of brake pipe leakage which would reduce the brake pipe pressure 3 p.s.i. during the first minute immediately after the 15 p.s.i. reduction has been completed, the leakage from the train brake pipe measured in this manner would be observed to be 3 p.s.i. per minute regardless of train length. In making this test the application has caused the feed grooves of all the triple valves to be closed and the loss of air is therefore measured from the brake pipe itself, including the branch pipes.

The care with which the A.A.R. brake pipe leakage test is made determines to a significant degree the validity of the result. It is easy to obtain a false reading by being in too much of a hurry. The standard instructions, which were written many years ago when long trains were the exception rather than the rule, do not specify the exact amount of initial charge (particularly on passenger trains) and do not define any time allowance for the brake pipe pressure to become equalized before the observation of pressure loss is started at the locomotive brake pipe gage. The practices of enginemen vary to a considerable extent. If the brake pipe leakage is relatively little, there may be a period after the equalizing discharge valve closes in which the brake pipe pressure remains steady or actually rises slightly. On the other hand, if the leakage is quite large, the quick service activity may continue at the rear end of the train during several seconds of the one minute timing interval. Both conditions will, of course, produce a false indication of actual pressure drop due to brake pipe leakage alone. It has been found by experience on train test racks that the best method is to make the initial equalizing reservoir reduction a few pounds less than 15 and to allow the brake pipe pressure to settle until the full 15 p.s.i. reduction is indicated on the air gage before the one minute timing is started. Much more consistent results will be obtained than by starting the timing immediately upon closure of the equalizing discharge valve at the 15 p.s.i. reduction level.

51 Points of Leakage

On a freight car there are a minimum of 51 points from which leakage can occur from the brake system when charged. Of these, 27 or more are in the brake pipe itself. This leaves 24 points of leakage (17 in the AB valve itself) which are included in what is known as brake system leakage, all of which may be on the reservoir side of the feed grooves. Any leakage that occurs at these 24 points is not taken into account by the brake pipe leakage test and, therefore, increases the air flow into the train only when the brakes are released and are charged.

On the average freight car equipped with AB brakes there is a total air volume in the charged brake system (exclusive of brake cylinder) of approximately 4 cu. ft. of which 0.5 cu. ft. is in the brake pipe. Nearly 1.5 cu ft. are in the auxiliary reservoir system and slightly over 2 cu. ft. are in the emergency reservoir system. The ratios of these volumes are approximately 1 for the brake pipe to 3 for the auxiliary reservoir to 4 for the emergency reservoir. On a terminal application test or single car test, leakage in cubic feet, of air lost from the auxiliary reservoir volume will not be easily found by the usual observations of brake action unless it is more than three times the brake pipe leakage. A brake will apply and remain applied over the intervals of time usually involved in such tests. If auxiliary reservoir leakage is greater than three times the brake pipe leakage in cubic feet of free air lost, auxiliary reservoir pressure will fall at a rate sufficiently rapid to cause the service portion of the AB valve to move to release position so that the brake will not remain applied. Leakage from the emergency reservoir system cannot be readily detected by observation of brake function during such tests. If it is so great as to interfere with charging, it may be detected by failure to obtain a charge within the 15-minute period under the single car code of tests. Generally, however, leakage from the auxiliary and emergency reservoir systems can be detected only by soap bubble tests or audibility of the larger leaks, such as cracked and broken pipes, loose pipe joints and fittings, etc.

When a train is fully charged, there exists what is known as a pressure gradient or brake pipe taper. This is the difference between the pressure in the brake pipe at the caboose and the pressure of the air delivered by the feed valve to the brake pipe. If there is a difference of 5 p.s.i., it is said that there is a 5-lb. taper in the train. If no leakage exists in the brake pipes or

reservoir systems of the cars, the pressure at both ends of the train will attain the same value and there will be zero taper. Under circumstances where there is leakage, there must, of course, be a continuous flow of air into the brake pipe to make up for *that* lost to the atmosphere. As this flow continues down through the train there is a gradual pressure loss due to friction through the pipes, angle cocks, and hose couplings. The greater the air flows, the higher will be the velocity and the greater will be the pressure drop. Hence, the presence of leakage to the atmosphere from the reservoir side of the feed grooves of the triple valves (AB service portions) will add to the leakage to the atmosphere from the brake pipes and will increase the amount of air that flows to maintain leakage while the brakes are released. The aggregate of brake pipe and reservoir leakage is known as system leakage as distinguished from brake pipe leakage alone as determined from the A.A.R. leakage test. An abnormal difference between brake pipe leakage and total system leakage on a train in actual service will give different results, always in the direction of greater gradient than expected. This is because the total leakage flow which establishes the value of the gradient is greater than that required to maintain brake pipe leakage alone.

Under laboratory conditions it is possible to obtain an exact measurement of the gradient or brake pipe taper because the end of the train can be relatively close to the front of the train and the difference in brake pipe pressure measured by the use of a manometer or other accurate differential pressure measuring devices. Such accuracy is practically impossible to obtain on a made-up train standing in a railroad yard. Most observations are made from reading the brake pipe gage on the locomotive and the brake pipe gage in the caboose. For special tests carefully calibrated and matched air gages may be used, but in ordinary practice rarely are. Even if the best test gages are employed their accuracy is rarely better than plus or minus 1 p.s.i. which could immediately lead to a discrepancy of as much as 2 p.s.i. in the determinations of train taper. The usual locomotive and caboose gages are frequently much less accurate and in some cases have been observed to be as much as 4 or 5 p.s.i. off when compared with an accurate test gage. It is quite important, therefore, to recognize the approximate character of gradient readings on trains in actual service.

The location of existing brake pipe leakage has a serious effect upon the fully charged brake pipe gradient. Since the A.A.R. leakage test cannot indicate to the engineman where in the train the leakage is located, apparent discrepancies will frequently be noted in the gradient attained on two trains of the same length and brake pipe leakage. The more uniformly the brake pipe and system leakages are distributed throughout all the cars, the more nearly will the gradient approach what is expected from laboratory results. Invariably a gradient far greater than that expected will mean (a) that the brake pipe leakage is concentrated at the rear of the train or (b) that there is an abnormally large system leakage perhaps also towards the rear of the train. Since the gradient is established by pressure drop of air flowing through the brake pipe to the points of leakage, the gradient will be greater as the air flow is larger and as the distance through which the air must flow is increased.

Variations in Leakage

The lowest levels of pipe leakage and gasket leakage are recognizable from soap bubble tests. Seep leakage may be considered the sort that results in a froth of fine soap bubbles when soap suds are applied over the entire area of a joint. It is of a low value in terms of actual air lost. Although difficult to determine exactly, seep leakage appears to represent values up to a maximum of about .001 cu. ft. of free air per min.

Leakage of a somewhat greater magnitude is recognizable by one or more growing soap bubbles which collapse within a short time. The maximum leak that will allow a soap bubble to be formed even for a brief time appears to be of the order of .14 cu. ft. of free air per min. Any single leak larger than this cannot be readily detected by soap suds because the velocity of escaping air is too great. A leak of this magnitude may be barely audible if there is no extraneous noise. A leak of the magnitude of roughly, 30 cu. ft. of free air per minute or greater generally is audible to the average person under the ordinary noise levels of a train yard or repair track.

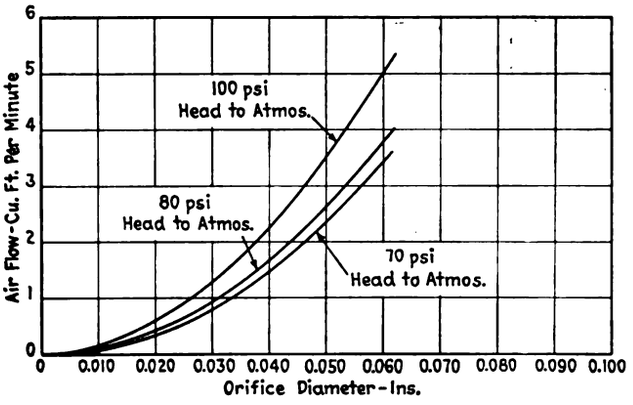


Fig. 1—Air flow in cu. ft. of free air per min. from charged pipe to atmosphere through small orifices

Fig. 1 presents curves of actual air flow to the atmosphere through various size orifices from head pressures of 70 p.s.i., 80 p.s.i., and 100 p.s.i. It will be noted that from 70 p.s.i. an air flow of .14 cu. ft. will occur through an orifice of .013 in. diameter, or slightly smaller than a No. 80 drill, and .30 cu. ft. through an orifice of .0185 in. diameter, or slightly larger than a No. 77 drill. A No. 57 drill orifice of .043 in. diameter will pass approximately 1.7 cu. ft. of free air with 70 p.s.i. head pressure and 1.95 cu. ft. per min. with 80 p.s.i. head pressure.

If on a car there is a leak to the atmosphere from the reservoir side of the triple valve of sufficient magnitude to prevent any pressure to be developed while charging is taking place through the AB valve, the maximum loss of air will be limited to the flow capacities of the charging chokes (feed grooves). The size of these orifices are a No. 57 drill in the service portion and a No. 73 drill in the emergency portion. The curves of Fig. 1 show that when the brake pipe pressure at the triple valve is 70 p.s.i., the total air flow would be approximately 2.25 cu. ft. of free air per min. This would, of course, be the extreme case and intolerable in service in that the brake would never become charged and would never apply on an application test. If the leak from the reservoir side is of such magnitude as to allow the reservoirs to become charged to only 45 p.s.i., the size of the orifice through which air is lost to the atmosphere would be almost exactly the same as the combined sizes of the charging chokes. Under these conditions the actual air lost through leakage would be approximately 70 per cent of the maximum or 1.6 cu. ft. of free air per minute. This condition again would be intolerable since the brake would not apply on an application test.

The maximum air leakage from the auxiliary reservoir that could be tolerated on a single car, where the brake pipe leakage is 5 p.s.i. per min., is approximately 0.5 cu. ft. of free air per min.; and where the brake pipe leakage is 2 p.s.i. per min., is 0.2 cu. ft. of free air per min. Therefore, if a train of cars shows a brake pipe leakage of 5 p.s.i. per min. on the A.A.R. leakage test, each car of the train must have the leakage on the reservoir side reduced to 0.5 cu. ft. per min. or less for the brake on that car to remain applied during the application portion of the terminal test. This sort of leak should be in the audible zone and, consequently, readily detected during terminal inspection.

What Establishes the Gradient

Now, how will such train system leakage affect the gradient? Let us assume for one case that all cars in a 100-car train have uniformly a leakage from the reservoir side of the triple valves of 0.5 cu. ft. of free air per min. from a head pressure of 70 p.s.i. This leakage will make the system leakage of the train far larger than any tolerable brake pipe leakage. It cannot be assumed that the leakage flow will be increased by 50 cu. ft. per min. (100 by 0.5) because the gradient will not produce the 70 p.s.i. head pressure in any except the first few cars of the train. Actually, the additional leakage flow will be somewhat less than 50 cu. ft. per min., say, 40 cu. ft. per min. This would add to the flow required to maintain the brake pipe leakage of 5 p.s.i. per min., which under these circumstances would amount to about 25 cu.

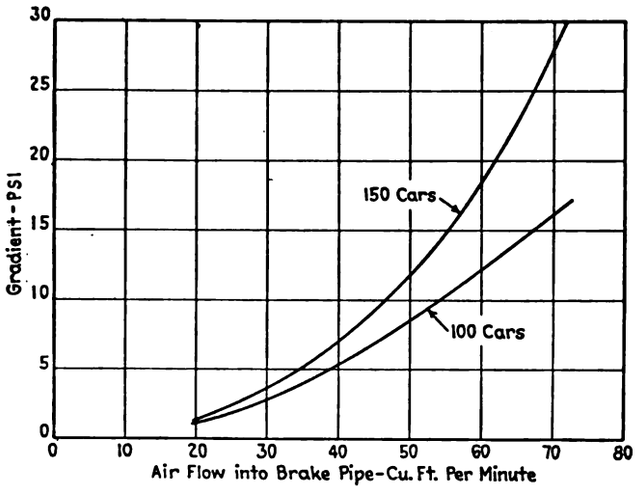


Fig. 2—Gradient caused by flow of air to maintain uniformly distributed leakage with 80 p.s.i. brake pipe pressure

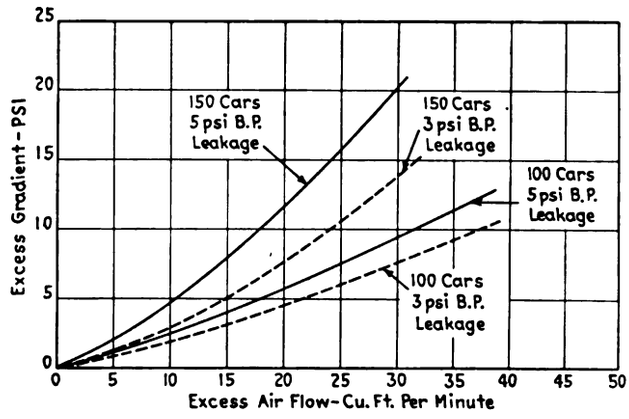


Fig. 3—Excess gradient resulting from excess system leakage. Leaks uniformly distributed with 80 p.s.i. brake pipe pressure

ft. per min. and the result would be a total flow of approximately 65 cu. ft. per min. Fig. 2 is plotted from laboratory tests to show the gradient in 100 and 150 car trains that results from a total air flow of various magnitudes supplying uniformly distributed leakage. Were there practically no additional system leakage the air flow to maintain 5 p.s.i. per minute brake pipe leakage on a 100-car train would be approximately 30 cu. ft. per min. From the 100-car train curve of Fig. 2 it will be observed that the gradient would be approximately 3 p.s.i. where the brake pipe and system leakages are substantially the same, but increased to approximately 14 p.s.i. by the addition of the reservoir leakage assumed in this case.

The gradient in trains having the same brake pipe leakage increases quite rapidly with an increase in train length. To illustrate how the presence of additional system leakage produces the same effect to a startling degree, let us assume a 150-car train with the same conditions of brake pipe leakage and total system leakage as outlined in the paragraph above. The additional air flow due to reservoir leakage would be about 55 cu. ft. per min. and the total air flow about 85 cu. ft. per min. The air flow to maintain 5 p.s.i. per min. brake pipe leakage alone would be about 40 cu. ft. per min. From the 150 car curve on Fig. 2 it will be noted that the gradient would be approximately 7 p.s.i. where the brake pipe and system leakages are substantially the same, but would be increased to approximately 46 p.s.i. by the addition of the reservoir leakage. This point is not even shown on the curve of Fig. 2.

As a train is made up and its charging is started, there is no way of telling what leakage may exist or where it is located. There may be a car or two with broken crossover pipes or other causes of excessive reservoir leakage. There may be a number of serious brake pipe leaks at hose coupling gaskets, angle cock connections, 10 in. nipple couplings, etc. Certainly it cannot be expected that every car has zero reservoir leakage or an aggregate system leakage that is the maximum tolerable on a single car basis. Let us, therefore, take another case which may be more practical in its assumptions. Assume that a train of 100 cars on which work has been done while it is being charged to the extent that the brake pipe leakage has been reduced to 5 p.s.i. per min. In this train there are two cars, one towards the front end and one towards the rear with broken crossover pipes which leak to the extent of preventing these individual cars from obtaining a satisfactory charge. Leakage from these cars may run all the way from 0.7 to 2.25 cu. ft. per min. On 20 other cars uniformly distributed through the train there are auxiliary reservoir leaks which are in the lower level of the audible zone, each producing a loss of about 0.3 cu. ft. per min. The total flow to maintain the brake pipe leakage would be about 30 cu. ft., and the total flow for all leakages would be about 40 cu. ft. From Fig. 2 it will be seen that the additional 10 cu. ft. per min. air flow would increase the gradient about 2.5 p.s.i. In a 150-car train with the same proportion of cars with an equal degree of leakage, both in the brake pipe and reservoir systems, the extra flow caused by reservoir leakage would be approximately 15 cu. ft. per min. and the gradient would be increased from 7 p.s.i. to 15 p.s.i.

The above hypothetical cases may not appear to fit any actual service conditions. They are intended to disclose the influence of system leakage, both in magnitude and in trend, following increasing train lengths.

To illustrate graphically and understandably the influence on gradient of system leakage other than that from the brake pipe alone is rather difficult. Fig. 3 attempts to do so for train lengths of 100 and 150 cars with 3 p.s.i. per min. and 5 p.s.i. per min. brake pipe leakage. The values given represent the excess gradient beyond that produced by the brake pipe leakage alone. If system leakage and brake pipe leakage are the same, there is no increase in the normal gradient. From the 100-car train curve (solid line) it will be noted that when system leakage is such as to require 20 cu. ft. per min. greater flow than that required to maintain a brake pipe leakage of 5 p.s.i. per min., the gradient will be 5.5 p.s.i. greater than normal. It is readily apparent that as the train length increases less reservoir leakage can be tolerated. The values given are for a uniform distribution of both brake pipe leakage and system leakage.

Soap Suds Test Is Sound

It should be clear that in maintenance practices attention should be directed to reductions of leakage in the reservoir system of cars as well as in the brake pipe system. The single car code of tests includes a brake pipe leakage test which holds brake pipe leakage to no more than 2 p.s.i. drop in pressure in 1 min. There is also an auxiliary reservoir leakage test which limits auxiliary reservoir leakage to a reasonably low value. There is, however, no test for emergency reservoir leakage and no practical operating test can be devised to indicate and hold such leakage within tolerable limits. The common practice is to apply soap suds to points of possible leakage within the reservoir system while the equipment is being charged. This appears to be the only practical way of locating and eliminating emergency reservoir leakage and should be rigorously practiced. In fact, the practice of soaping all points of possible system leakage is very sound, since small leaks can thus be detected and eliminated before they become serious.

Further questions have been raised concerning the effect of feed valve setting upon the gradient of a particular train. At brake pipe pressures commonly used the amount of leakage through a given hole is a function of the density of the air within the reservoir or pipe, which in turn is directly proportional to the absolute head pressure. It follows that as the feed valve pressure

is increased, the amount of air lost through leakage will be correspondingly increased and the flow to maintain this leakage will be increased. Increasing flow means increasing gradient so that a given train with a certain leakage condition will have a greater gradient at 80 p.s.i. brake pipe pressure than at 70 p.s.i., and still more at 90 p.s.i. For instance, a 100-car train with a 3 p.s.i. gradient at 70 p.s.i. feed valve setting would have a 4½ p.s.i. gradient at a feed valve setting of 90 p.s.i because the actual air flow would increase by about 25 per cent.

There is also the probability of some effect of the higher pressure on the size of the leakage orifices, such as greater stressing of loosened joints. This, in itself, may add to the air flow and, consequently, make the gradient even greater.

A helpful device for indicating the presence of excessive leakage is a brake pipe flow indicator on the locomotive. If it is the type with graduated dial and indicating pointer, the level of flow will have a fairly uniform indicated value for a given normal gradient for a certain number of cars. On a train of a given number of cars with a fairly uniform distribution of leakage which produces a tolerable gradient, the flow indicator will show a normal reading for that train length. It will soon be recognized from the dial indication that any train of the same length which shows a considerably higher reading must have excessive leakage and gradient. From watching the flow indicator this will become apparent before an attempt is made to run the terminal leakage test. Experience on many trains of different lengths will develop empirical maximum indications within which satisfactory operating conditions of trains could quickly and readily be judged.

There is need for careful policing of yard and repair track maintenance work. There are certain factors relating to air flow and pressure loss which you cannot alter. The size of the brake pipe has been established for many years as a good compromise between excessive volume and excessive restriction and the brake system devices have been built and calibrated around it. Modern feed valves have been increased in capacity to a point where they promptly establish and maintain their set pressures at the front end of trains of any practical length. The laws of flow through pipes and restrictions cannot be changed nor can man do anything about the amount of air that will be lost through a leakage orifice of a given size. But everyone can aid in reducing the number and size of leaks in the brake system. This requires constant vigilance and careful supervision of maintenance practices, not only at one point, but at all points on all railroads.

The report was prepared by H. N. Sudduth, director of air brake engineering, New York Air Brake Company.

Discussion

Opinions were expressed on the necessity of getting the information in this paper to the car knocker, on providing sufficient time and means for checking leaks, on the need for more men if we expect to continue to run long heavy trains, and on acquainting top ranking car department officers with the effects of leakage so that they will understand the problems of the air brake man. One member said that all would agree that this was a fine paper but what is being done about it? The A.A.R. asked that leakage and piston travel be adhered to 18 months ago, but it is doubtful if half of what can be done is being done. There are not enough air brake men today yet management is taking men off where more are needed. In checking in-date cars this member found that many AB valves in service only 18 months require repairs, and that many repairs are being made that are not proper. Unless these conditions are remedied the large investment in diesel power will be largely wasted because, with excessive leakage and gradient, you cannot safely handle long trains. Coal oil is being found in parts, indicating that "coal oil repairs" are being made, meaning just washing off the outside and calling it a job. Another member said that air brake conditions are the best ever and is therefore worried that things will get far worse as car department officers will begin to think that the air brake problem is solved completely. Air brake failures are now a minor item on his delay sheets. He thinks that this paper gives excellent ammunition with which to go to the management to illustrate the problems that the air brake man is facing.

One speaker felt that the rip track is where the improvement is needed. The A.A.R. tells what to do but is unable to get compliance. This information can go to car department men but will it help when they won't even comply with simple rules? It is not difficult to understand a rule requiring leakage to be kept to 2 p.s.i. per min., another requiring that reservoirs be tight, etc. Too many rip tracks don't even know what a soap bucket is and don't pay attention to A.A.R. rules. It is here where improvement is needed. He did not feel that conditions were better than before. The causes such as loose pipes must be done away with. Making a one-day inspection of any rip track will show why this is where the improvement is needed, and that too little attention is paid to what the A.A.R. committee has done and what they recommend.

* * *

COORDINATED REGISTRATIONS—1950-1951

Associations	1950 Railroad Men	1951 Railroad Men
Air brake	176	280
Master Boiler Makers'	216	215
Car Department Officers'	373	563
Locomotive Maintenance Officers'	746	1,017
Railway Fuel & Traveling Engineers'	475	268
Electrical Sections, A.A.R.	175	155
	2,161	2,498
	Supply Men	Supply Men
Railway Electric Supply Manufacturers'	236	
Allied Railway Supply	737	
Allied Railway Supply, Mechanical	...	1,152
Allied Railway Supply, Electrical	...	168
	973	1,320
Total	3,134	3,818

Note: The 1950 exhibit was of electrical equipment and the 1951 exhibit was mechanical equipment. The supply companies' registration of representatives, therefore, is not directly comparable.





A. F. Stiglmeier
Sec.-Treas.
(General supervisor boilers and welding, N. Y. C. System)

R. W. Barrett
President
(Chief boiler inspector, Central Region, C.N.R.)

H. C. Haviland
Vice-Pres.
(Supervisor boilers, N. Y. C.)



Master Boiler Makers Broaden Scope of Association's Work

RECOGNIZING the adverse effects of dieselization on the boilermaker's craft the Master Boiler Makers' Association took action at its 34th annual meeting to strengthen the association by giving more recognition to the allied fields of welding and water service. The association adopted changes to its constitution that permits welding and water service supervisors to become active members and officers, who heretofore have been restricted to boiler men.

President R. W. Barrett, who presided at the meeting, and Secretary-Treasurer A. F. Stiglmeier spoke to the membership on the association's work and status at the opening session. Each pointed out the need for additional active members and mentioned the efforts of the association in expanding its work to deal more fully with new subjects. Next year marks the 50th anniversary of the forming of the association and plans will be made to celebrate this event by a special program.

During the three-day meeting at Chicago, September 17-19, guest speakers made several suggestions for utilizing the experience and training of boilermakers in other than steam locomotive work. In an address before the opening session D. V. Gonder, assisant vice-president-operations, Canadian National, said the attitude of boiler makers should be, "Now that there is less steam locomotive work, to what other repairs and manufacture can my skill and knowledge be applied?" He said that it is time for the boiler maker to get out of the specialist class and learn a variety of work as "it is no use seeking other work if you know nothing about it."

Specifically, Mr. Gonder suggested that work that has gone to outside contractors, such as for the construction of oil and water tanks and the fabrication of smoke and heating ducts, might be done by the boiler department, provided costs meet outside competition. Other work might include the repair of structural steel members, stationary boiler repairs and steel car work.

E. H. Davidson, director, Bureau of Locomotive Inspection, said it "is economically unsound not to utilize to the utmost the trained services of men experienced in the art of boiler making." He suggested that the construction and maintenance of fuel oil tanks and reservoirs is a subject to which boiler makers could profitably direct their attention because oil leaks and inflammable debris have become troublesome problems.

In respect to steam locomotives Mr. Davidson said that "the introduction of a new type of motive power is not justification for the neglect of steam power." He urged the boiler makers to give more attention to the steam locomotives because, unfortunately, accidents seem to increase with the age of the equipment. Particular attention, he said, should be given to the condition of staybolt threads, parts of the wrapper sheet and back head where men work in close proximity to the boiler shell, and to the cleanliness of both external and internal heating surfaces.

Two reports, abstracts of which are not included in this issue, were presented at the meeting. One was a two-part report on (a)—the maintenance and testing of stationary and portable air reservoirs (other than locomotives and cars), and (b) the care and maintenance of stationary boilers. This report was presented by H. C. Haviland, supervisor of boilers, New York Central. The second report was on the fabrication and testing of stationary boilers and the chemical descaling of stationary and portable boilers. The chairman of the committee was S. F. Wentz, assistant supervisor of boilers, New York Central.

Feedwater Treatment Reduces Blowdowns — Controls Foaming

Any program involving tangible savings will be welcomed *by* the railroad management. A comparative study shows that boiler feedwaters conditioned to permit the carrying of high dissolved solids show savings in fuel far out-weighing the cost of additional chemicals used for this purpose. There are many intangible savings which should be considered but which are difficult to evaluate. Among these is the reduced maintenance of superheater units, valve bushings and cylinder packing.

Dissolved Solids

The ordinary conception of dissolved solids consists of sodium carbonate, sodium hydroxide, sodium sulphate, sodium chloride and small amounts of nitrates. To these we must add sewage and organic contamination which has increased greatly with industrialization and increase in population. These developments have increased contamination of surface and shallow-well supplies by pouring vast amounts of sewage, synthetic detergents and wetting agents and other forms of pollution into the water supply. The corrosive action of these types of pollution is readily controlled by proper alkalinity but the foaming properties are sometimes not so easily handled.

Foaming

Control of foaming is the latest advance in the art of water treatment. From all the discussion emerging from the relative parts played by suspended matter and dissolved solids, it seems reasonably clear that dissolved solids is the major cause of the difficulty. The early method for the control of foaming was excessive blowing, frequent water changing and boiler washing. One early preventative was the use of castor oil, this material being only a partial solution because frequent water changes and washes were still necessary. The most recent advance was the introduction of pulverized steam conditioners which prevent foaming at unbelievably large total solids. This compound does not saponify or form soap in the boiler and has a much longer effective life than the old oil type antifoams. Furthermore, it does not form objectionable compounds which require removal by frequent washing and water changing. When using it the boiler washes can be reduced to the legal limit and water changes entirely eliminated. Obviously, the longer we can keep the conditioned water in the boiler the less the danger of scale and pitting from the fresh water refill.

Conclusions

On one northwestern railroad using steam conditioner, organics, phosphates and the usual water treatment, the engines are dispatched from the terminal with total solids of 1,000 grains per gal. On another railroad using similar treatment, total solids between 700 and 1,800 grains per gal. are normal. On a branch line total solids as high as 3,400 grains per gal. have been safely carried. Corrosion, pitting and grooving are non-existant in the cases mentioned. The evidence is conclusive that there will be no attack on the boiler metal at exceedingly high total solids provided the alkalinity is maintained at proper levels at all times with the addition of a mixture of organics and polyphosphates in small amounts.

Oil has no place in a boiler. Under no circumstances should it ever exceed one percent of the suspended matter. The damaging effects of oil have been overlooked and disregarded largely because of the difficulty encountered in making the mechanical changes necessary to prevent oil from getting in a boiler.

In the early days of water treatment the economics of carrying high dissolved solids and the elimination of water changes and washes could not be realized because of foaming. The introduction of powdered steam conditioners has changed the picture so that foaming is the least of our difficulties, permitting us to carry total solids to any point, thereby realizing the economy of reduced blowdown and boiler washes.

The report was submitted by a committee of which F. E. Godwin, system chief boiler inspector, Canadian National was chairman.

Effects of Boiler Supports and Machinery Pounds on Boiler Failures

While the opinion has been quite generally held that the causes of boiler shell and casing failures have their origin in the boiler itself many supervisors of boiler maintenance and construction have doubted this theory for a long time. In many instances regardless of the strength employed in making repairs, failures continued to occur at the same location.

Based upon information obtained through limited surveys this committee believes that pounds, broken frames and stuck or gauled expansion shoes do have a direct bearing on boiler maintenance and that their effect can be unmistakenly traced. It is our recommendation that where boiler waist sheets are used that a sliding type be employed with a large wearing plate between boiler and waist sheet angle, for better shock dissipation, and that waist sheet angles be maintained with a close fit to boiler at all times, to reduce severity of pound. Where expansion shoes are employed they should be closely inspected and if worn more than 1/16 in. should be removed and properly restored to their blue print measurement. The practice of inserting shims to take up excessive wear in expansion shoes should not be tolerated. They do not compensate properly for unevenly worn shoes and are applied without oil grooves and frequently are applied too tight thereby preventing free movement of boiler on shoes.

If expansion plates are used at front or back of firebox careful inspection should be made at all times to note whether they are broken or cracked or whether their free movement is restricted due to an accumulation of dirt or other foreign matter. When defective expansion plates are detected immediate repair should be made so that they can function as intended. If rocker castings are employed at rear of engine bed they should be checked to see that they have not become worn away from the proper radius. These castings when not in true radius prevent the free side movement of frame and boiler while engine is curving, holding it fast momentarily and then releasing itself sharply causing undue shock and strain to both boiler and frame.

Canadian Pacific

In answer to a questionnaire W. A. Newman, chief of motive power and rolling stock, Canadian Pacific, indicates clearly that fairly good conclusions as to the causes for certain boiler failures can be reached if only enough time and study are given to the subject. After citing some specific cases Mr. Newman concluded his report as follows:

"It is very difficult to determine whether pounds due to improperly maintained rod bearings, driving boxes, shoes and wedges are responsible for boiler shell failures, but judging from our experience on the 4-8-4 type locomotives and the twenty earlier 2-10-4 type locomotives coupled with exceptionally good results on high speed 4-6-4 passenger type locomotives, I am forced to believe that pounds due to improperly maintained bear-

ings, etc., have little effect. Boiler waist sheets fastened to both boiler and frame should not be a contributing consideration providing the waist sheet is long enough to be flexible, to take care of the longitudinal expansion in the boiler shell at the point where it is applied.

"We have no reason to believe that improper maintenance of floating boiler waist sheets is responsible for boiler trouble. I do believe, however, that improper fitting of the waist sheet to the boiler barrel can cause trouble as we have seen evidence of the outer section wearing the boiler shell or the liner applied under same, indicating that the radius was formed so that it would fit tightly at the outside and not in the center. Also this wear may be due to the diametral expansion of the boiler shell, the expansion being restrained at the outer edges of the waist sheet angle or T-irons. For this reason I think it is desirable to allow a slight clearance between the shell and the outer portion of the angles or T-irons. Improperly maintained expansion plates under the firebox or expansion shoes can definitely contribute to boiler shell failures."

The report was presented by the committee chairman, A. A. Edlund, assistant general boiler inspector, Chicago, Milwaukee, St. Paul & Pacific.

Washing and Testing Steam Generators

This topic was presented as individual reports by the committee members. Because of the length of these reports only the one prepared by the committee chairman, S. H. Christopherson, supervisor of boiler and welding inspection, New York, New Haven & Hartford, appears in this issue.

Mr. Christopherson's Report

The cure, we believe, for the failures of steam generators will be the same as we have advocated for years in our proceedings on steam boilers, only it may be placed before us in a different language. We do believe that part of the cure lies with the builders of diesel locomotives and their representatives who apparently view the steam generator as a secondary device that can be placed wherever there is room for it. This makes proper maintenance a slipshod affair. For in order to function successfully during the trip a general inspection of each operating part under orifice test must be made. We have yet to find a supply water tank placed and built on a diesel locomotive so that it can be properly washed out and kept clean. These water supply tanks must be built so that no obstruction will stop the flow of water at the bottom when washed, as practically all sediments will be found at the bottom.

Washing Procedure

The washing of steam generator coils is done in accordance with I. C. C. rules. The railroads have adopted the acid wash. Ever since 1941 acid has been used as an agent to clean out coils. The acid wash was used at every boiler wash up to 1949 when it was decided to use the acid wash only on quarterly inspection and so far we have seen no difference. However, if for any reason a report comes in that the water relief valve on water pump let go or of high water pressure on the gauge the generator is given an acid wash. After a thorough wash with acid, using soda ash for an inhibitor in clean water, the generators are filled with water and fired up and with a steam pressure of at least 245 lb. the coils are back blown several times until clean water comes out from the generator coil blow down valve. This back blow of the coils is done repeatedly at all terminals upon arrival regardless of the time between runs.

After being thoroughly back blown the generator is then filled and fired up and an orifice test applied for a short period and a general inspection given while under this test. During the early period, 1941 to 1948, the generator water was treated, using the treatment tank as means of supplying treated water to coils. This way of treating water did not lengthen the coil life.

Coil Repair

In the early years of the generators, erosion corrosion would develop within 24 months in the outer coil at the inlet and outlet. The construction of these early coils may have had something to do with the failure as the tubes were bent quite sharply at the inlet and outlet. This failure also occurred in the intermediat coils within 28 to 32 months. This condition of a sharp bend was rectified in the later years and a general corrosion now takes place starting from the nipple connection to the inlet and outlet of both the outer and intermediate coils and we have found this corrosive action in the intermediate run of the outer coils way up near the top portion of the coil assembly. The inner coil has outlasted both the outer and intermediate coils. The defects found at the inner run of inner coil has been sometimes a stress crack or may be a pin hole, which would develop in 32 to 36 months. If it was found that the material could be welded these pits or cracks were welded up.

When these coils were finally removed certain repairs were tried out such as a complete length of new tubing (about 20 ft.) would be rolled to fit the coil in question—this new tubing would take in about three runs in the outer run of outer coil and about four runs in the inner run of outer coil. This type of repair would last about 18 months or less when corrosion would take place in the old tubing just ahead of new tubing applied previously.

As this had to be a continuous job of removing and reapplying coils and gave us no assurance of comfort during the winter months it was decided that no further repairs as mentioned would be made on coils found to be four years old upon removal. This has proved to be the right thing to do on the New Haven. However, we would suggest that each railroad check the life of each coil and then draw up a plan for renewal. In fact, on the later 4530 and 4630 steam generators we had to set up a plan for renewal of the coils after three years of service. These generators came to us in the latter part of 1948 and early part of 1949 and within 19 to 23 months the outer coil developed defects and had to be renewed, The most peculiar part is that the outer coils which were renewed have given us trouble within 9 months. During the summer of 1951 we hope to renew all coils and start with a new set of coils. To cure this trouble we believe that a water treatment must be used in the supply tank and the tank must be kept clean. The 4530 and 4630 have never used treated water.

Heavy Repairs

On diesel units coming into shop for heavy repairs we have a standard procedure in that we remove generator and separator complete and place them at designated place. Where every device and appurtenance is removed it is either washed or cleaned by whatever method used for each device. The coils are removed and a check is made of their age and condition. If found to be usable all coils are placed within each other and placed in a furnace and annealed at about 1,000 to 1,200 deg. F. We believe this procedure will give new life to coils and at the same time loosen up anything that will adhere to the inside of coils. Coils are then given a thorough wash, alternating with steam and water and using a hammer continuously on all parts of coils while under this wash.

After being satisfactorily cleaned, coils are then given a hydrostatic test at 600 lb. If defects are found under hydro and coils are above age limit. If within nine months of limit the coils are scrapped, if above that, shop is so equipped that we apply a full length of tubing, rolling coils upon drums of different diameter which will fit the inner run or outer run of any coil as may be needed. The coils so repaired are sent to the terminal for their use.

Shops do not use repaired coils on renewal. All coils applied by shop are new coils. All refractories are removed from containers and recast, using home made forms.

Corrosion

One of the most frequent causes of corrosion in heating boilers as now used on diesel power is failure to care properly for idle boilers and water supply tanks. However, we feel that improvement could be made by the builders in using the known fact that we have today coatings which will stop practically all oxidation of water supply tank material. We believe an unclean tank will shorten the life of coils.

In comparison with other railroads the New Haven has short runs but the utilization is very much the same except that units are operated at high capacity for a period of four hours and then shut down. During this idle period all water which is in the coils will evaporate and whatever total solids are in that water will bake onto the metal. The records show that during 1948 and 1949 twenty-seven 3,000-lb. generators were received and operated for a period of 16 to 20 months before it became necessary to renew the outer coil owing to corrosion. During this time the tank water was getting pretty had, occasionally the water flow indicator would black out. Inside of nine months with the second renewal we were in trouble again and it is our opinion that the wording of how to maintain a water supply tank is wrong—it states it should be flushed out. This to us as boilermakers means just a change of water. Water supply tank should be thoroughly washed at least once a month and have sufficient washout plugs.

All-Welded Replacement Boiler Shell

The committee presenting the report on all-welded boiler shells noted that the assigned topic was the all-welded boiler but because present interest lies almost entirely with the all-welded fabrication of boiler shells it confined its report to this subject.

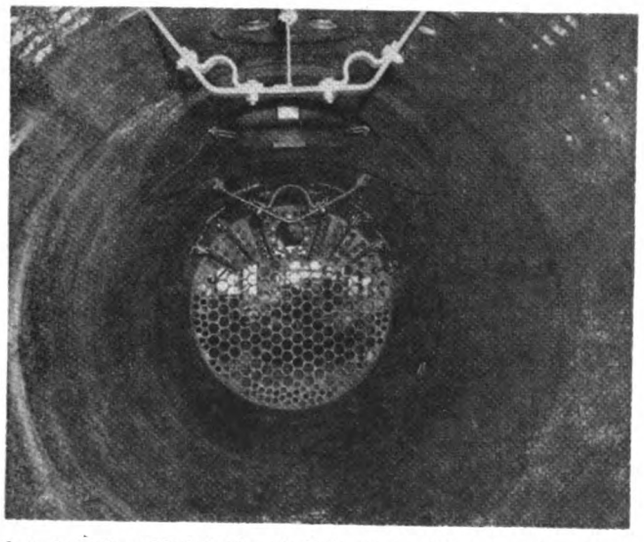
The all-welded boiler shell assembly was developed as a replacement shell for the riveted boilers, the riveted shells of which were proving to be an increasing source of trouble, especially on boilers constructed during the previous ten years. These boilers were designed to meet the requirements for additional power and their designs introduced:

(1) Alloy Steels in the construction of locomotive boilers.
(2) Larger capacity boilers, within restricted weight and clearance limitations.
(3) Higher boiler pressures.

The results were an epidemic of cracked boiler shells, with the cracks concentrated in the riveted longitudinal and circumferential seams. The causes of this cracking were fully covered in the 1947 and 1948 Proceedings of the Master Boiler Makers' Association and the answer is still the same—the all-welded boiler or its smaller component the all-welded shell assembly.

As this condition developed principally on the modern steam locomotive, which, under most circumstances would undoubtedly be the locomotives delegated to the role of secondary power in any dieselization program, the use of the all-welded shell assembly as an economical means of extending the life of these locomotives was the most logical answer.

The construction of the all-welded shell assemblies in the various plate fabricating shops who have undertaken this work, has followed the procedures of welding as covered in the A.S.M.E. Code for Locomotive Boilers. Thee procedures are everyday practices in these shops and the additional requirements of the railroad company specifications once understood and agreed upon were quickly absorbed into their routine operations.



Interior of welded boiler shell built in 1950 for New York Central's Class J3A locomotive by Combustion Engineering-Superheater, Inc.

SUMMARY OF ALL WELDED BOILERS AND BOILER SHELLS BUILT TO DATE

Railroad	Boilers	Shells	Date Built
Delaware & Hudson	1	..	1937
Delaware & Hudson	1	..	1947
Chicago & Northwestern	5	..	1946
Chesapeake & Ohio	5	..	1946
Chicago, Milwaukee, St. Paul & Pacific	10	..	1947–1948
Canadian Pacific	12	..	1945
New York Central	1	..	1945
New York Central	..	24	1948
New York Central	..	10	1949
New York Central	..	20	1950
New York Central	..	12*	1951
Atchison, Topeka & Santa Fe	..	25	1950–1951
Northern Pacific	..	10	1950–1951

* On order.

These first groups of all-welded shell assemblies were complete ready for application to the smokebox and firebox of the boiler with practically no work to be done on the shells in the railroad company shops. It soon developed that a large portion of the cost of these shell assemblies was in the fabrication and application of parts that could be more economically applied to the shells in the railroad company shops and in doing so eliminate the work that was foreign to the welded plate fabricating shops. Thus the latest all-welded shell assemblies consist only of the first, second and third shell courses, with such parts as liners, front tube sheet flange rings, etc., that are considered integral parts, welded to the shell, simplifying the job for the plate fabricating shops and permitting the railroads to utilize to the full extent all usable parts from the existing riveted shells, thus keeping to a minimum the cost of the repairs.

Reports received from the majority of the railroads with all-welded boilers and shells indicate that they have proven satisfactory in service with no repairs to the welds or welded areas to date, thus increasing availability of locomotives as compared with their performance when equipped with riveted shells.

The report also covered the details of the application and testing of shell assemblies in the railroad shops.

The report was submitted by a committee of which G. M. Davies, assistant engineer equipment, N.Y.C., is chairman.

Discussion

How long does it take to apply a welded shell? The New York Central takes about three weeks, the Santa Fe averaged one a month at Albuquerque, the Northern Pacific required more time. The variations in time are dependent on how complete the boiler shell is when delivered.

In answer to a question by M. R. Francis, general boilermaker, Norfolk & Western, on repairs to welded boilers, the answer was that these repairs are made in the same manner as those made to riveted boilers.

Diesel Subjects Dominate Traveling Engineers' Meeting

Locomotive operation, train handling, fuel storage and personnel training discussed. Steam fuel economy also considered



G. E. Anderson
President
(General fuel supervisor, Great Northern)

R. H. Francis
Vice-Pres.
(General road foreman, equipment, St.L.-S.F.)



L. H. Peters
Sec.-Treas.



A PROGRAM of 15 papers, reports and addresses in which subject matter pertaining to diesel locomotives and their operation predominated heavily over those dealing with steam was presented at the annual meeting of the Railway Fuel and Traveling Engineers' Association at the Hotel Sherman, Chicago, on September 17, 18 and 19. Seven items dealt with diesel locomotive operation, diesel fuel handling, diesel steam generators, and the education and training of diesel-locomotive operating personnel. Train handling, including both passenger and freight, and dynamic braking was the subject of a session in which the members of the Railway Fuel and Traveling Engineers' Association were joined by those of the Air Brake Association. Two reports dealt with fuel economy on steam locomotives, one on coal-burning service and one on oil-burning service. Three papers were on general subjects and the gas-turbine locomotive was the subject of one.

In opening the meeting President G. E. Anderson, general fuel supervisor, Great Northern, referred to developments of the past 50 years, including the advent of the diesel power with its greater availability, long runs, faster transportation, greater safety, better visibility, and greater comfort for the engineman. With the rapid change in motive power, he said, road supervisors all must become more alert and ready to help keep all men in the engine service fully informed.

Addresses

Edward H. Davidson, director, Bureau of Locomotive Inspection, in an address, reviewed the history of the organization and development of the Bureau of Locomotive Inspection and stressed the basic fact that "a well-maintained locomotive is a safe locomotive and is economical and efficient within the limits of its design. . . . Your organization," he said, "and we of the Bureau of Locomotive Inspection have much in common. We are charged with administration of the Locomotive Boiler Inspection Act and rules formulated thereunder and are definitely interested in matters affecting locomotive safety. As we succeed in raising the safety standard by elimination of locomotive defects, so we should be of assistance in your improvement of locomotive operation."

During the meeting John M. Hall, retired chief inspector of the Bureau of Locomotive Inspection, was called upon and spoke briefly.

The Gas Turbine

R. A. Williamson, manager, Railroad Rolling Stock Division, General Electric Company, reviewed the present status of gas-electric locomotives in the United States and elsewhere in the world, including the General Electric locomotive which has been in service on the Union Pacific. He followed this with a number of slides showing the 10 locomotives of this type now under construction for the Union Pacific in the General Electric plant at Erie, Pa.

When the operation of the G.E. locomotive was concluded on March 31, 1951, Mr. Williamson said that it had run about 95,000 miles in regular freight service on the Union Pacific and had burned about 1½ million gallons of fuel oil, about 95 per cent of which was heavy oil. Including service on other railroads, the locomotive had run a total of 106,000 miles, had burned 1,800,000 gal. of fuel, and had produced about 364,000,000 gross ton-miles.

Mr. Williamson reported a bucket failure in the second stage on the turbine rotor which produced relatively little other damage. The failure was attributed to fatigue produced by the resonance of the bucket to a particular operating speed not sufficiently above the actual operating speed of the turbine. A new rotor was installed and a new first stage nozzle also put in.

Abstracts and summaries of most of the papers and reports follow. In addition to those which appear here was an address on Safety on the Railroad, by W. H. Roberts, superintendent of safety, Chicago & North Western, a general survey of air pollution from all sources by Glenn Warner, fuel supervisor, Pere Marquette district, Chesapeake & Ohio, and a paper presented by F. Thomas, assistant to general superintendent equipment-diesel-electric, New York Central System, in which he outlined the functioning and controls of the Elesco and the Vapor-Clarkson steam generators for diesel locomotives.

C. H. Morse, Jr., manager, locomotive service department, Railroad division, Fairbanks, Morse & Co., answered 17 questions concerning the rating and various aspects of the functioning of diesel-electric locomotives. This paper will be the basis of an article which will appear in a later issue.

During the meeting President Anderson announced that the association now has a book of questions and answers for enginemen on Diesel-Electric Locomotives—Questions and Answers on Machinery, Air Brake and Operation, which sells for $2.

Employees' Contribution to Good Public Relations

By L. W. Horning

Vice-President, Personnel and Public Relations,
New York Central System

We sometimes hear it said that industry in general has only recently discovered that it has employees, and that it has a public. This is not to imply that industry traditionally has ignored these groups, but rather that it hasn't always applied to its relations with them the same degree of effort and skill that it has used in dealing with the more mechanical aspects of its existence. As a result, understanding between employees and management, and between public and management, has suffered; and all three parties have been the losers thereby.

In one way or another, all of you are in a position to influence the way a certain number of railroad men carry out their work assignments. Either by direct supervision, or by your work as technical staff men, you are in touch with the daily process by which the railroads produce their only stock in trade, their only marketable commodity—transportation. Occupying this strategic position—in or near the front line of supervision—you constitute management's most potent force for reaching the broad ranks of its employees. In brief, you are most opportunely situated for influencing railroad employees to exert the great power of which they are capable on behalf of their company's public relations.

Before you can address yourselves effectively to this task, however, you must yourselves be firmly convinced of the absolute indispensability to the railroad industry of sound, favorable relations with the public. To be thus convinced, you must face frankly some of the blunt facts about the present status of your industry. First, you must realize that the railroads are meeting with aggressive competition for the business which they need in order to operate profitably and continue to provide good jobs and opportunities for advancement. To win out over the competition, the railroads must persuade prospective shippers and travelers—meaning most of the public—that their best transportation buy is rail. Secondly, you must realize that the railroad industry—probably more so than any other—is subject to control by public agencies and to pressures of various kinds from public groups. Without good will and understanding on the part of the public, a railroad's life is likely to be harried by repeated persecutions and discriminations. Insofar as railroads presently suffer from just such harassments, relief will have to come largely as a result of improved public attitudes.

Indirect Influence

For practical purposes it may be helpful to center our discussion principally around engine-service employees. In the case of train service, the importance of public relations-conscious conductors and brakemen is obvious, just as it is at the ticket window and on the telephone. But in engine service, the field with which you have most contact, the connection between employee and public may not be so readily apparent.

Engine crews ordinarily have no personal contact with the passengers who ride, or the shippers whose goods ride, on their trains. Yet the men in the cab have a lot to do with whether the passenger enjoys a comfortable ride, and with whether the freight shipment arrives in safe and sound condition. The extra care that makes the difference between jerky starts and stops and cushion-smooth ones is something that rests in the engineman's hands. The handling of cars in freight yards—where shippers are won and lost—demands an engineman who knows his stuff and applies what he knows. The switching of passenger cars in terminals, particularly at night when passengers are sleeping, presents an opportunity for the engineman to make—or lose—friends for his railroad.

You need no reminder of the public relations problems that are created when engine crews fail to observe smoke control regulations in your communities. No explanations or excuses are going to pacify people who see a railroad's locomotives violating promises the railroad has made, breaking rules the railroad has agreed to keep. No statements by high railroad officials will carry one-tenth the weight with the public that the daily performance of the men in the engine cabs will.

Off the Job

The instances cited show some of the ways in which railroad employees of one class can practice public relations on the job. Not to be overlooked are the public-relations opportunities which they, and all railroad employees, encounter off the job. As members of their communities, and of various groups therein, they have wide circles of contact. The attitudes they reflect toward the company are going to help shape the opinions of their friends and acquaintances toward that company. The pride, or lack of it, they exhibit for the transportation product their company sells is going to influence those friends' and acquaintances' decisions when they purchase transportation. Unquestionably, railroad employees are closely identified in the public mind with the company and the industry they represent.

How, then, can we put to favorable use this tremendous public relations force, made up of many individuals? It is not enough for us, as supervisors, to look upon our employees as auxiliary public relations men. The employees must come to look upon themselves as such, and to accept public relations as a function of their jobs. Selling this idea to the employee is a task which must be performed principally by the supervisor, though he should have, of course, the support of the whole management team, right up to the top, in his effort to do so.

Create the Desire

The best way to get a man to do something is first to get him to want to do it. In the case of making public relations men of our employees, we have first to cause them to want to be public relations men.

First, we can share with our men our own knowledge of the conditions which our industry and our respective companies face. We can let them know what the company is up against in the way of competition, operating costs, overhead expense, then explain that getting more customers and winning more friends will help solve these problems.

This knowledge, of course, can't be forced into people's minds; we can't simply take people aside and cram facts into them. But we can keep ourselves up to date on the economics of our industry so that when an opportunity does arise—when a question is asked, when a statement is made—we'll be ready with the true story. Human beings basically are reasonable, and when they can be shown that a certain course of action is to their advantage, they'll follow it. Therefore, we must help our employees understand that what is good for their company is good for them in the long run.

An Essential Community of Interest

The great breakdown in industrial relations—responsible for most of our industrial strife—is the consistent ignoring of the essential community of interest between labor and management in a system which is built to work for both and also for the public at large. Whatever you, in your daily contacts with your men, by your attitudes and your actions, can do to increase the understanding of this point, will be solid, substantial progress toward a better America.

On a long-range basis we must work to instill in our men's minds the idea that public relations is part of their job. When they have accepted this idea, they will realize that their success as railroad men is measured in part by their success in dealing with the public, even though they do not—as in the case of engine crews—normally deal at first hand.

What we are talking about here, essentially, is not making the railroad employee over into something that he wasn't before. Rather we are talking about guiding and assisting him to realize a further potential in the interest of himself and his company. Many railroad men working for you right now are extremely public-relations-conscious. They are keenly aware that their jobs serve the public and depend for their existence on the public's fares and freight payments. You can tell, by talking to these men and observing their work, that they are conscientiously striving to make their railroad popular with the public. They offer proof and encouragement that others can be influenced to feel and act the same way.

A significant step forward in railroad public relations was taken last year when representatives of railway labor unions and representatives of railroad management jointly drafted a "platform" of public relations principles for railroad employees. This declaration affirmed the industry's need for public good will and the advantage to the employee of helping his company attain it. It also detailed ways in which railroad men and women can contribute to better public relations.

As this joint action suggests, there is a clear mutuality of interest between the unions and management in the matter of railroad good will. For any railroad labor union to believe otherwise would be to sabotage the very industry on which its existence depends. That would be about as short-sighted as it would be for a railroad management to refuse to recognize that unions are here to stay.

Employee Relations

In the rapidly increasing use of diesel power you very definitely have problems in the retraining and readjustment of your men. On the technical side, the job may not be too difficult; but, on the psychological side, the new power, like any new idea, has to be merchandised to the people who are going to use it. The reasons for adopting diesels, the tremendous investment involved in them, the hope they hold out for a sounder, more prosperous industry—all these things need explanation if we are to get the maximum cooperation of the men who will actually run the engines.

Years of research and planning, and millions of dollars, are going into dieselization on many of your roads. With them go the hopes of investors, managers, and employees for the future efficiency and soundness of those properties. To a considerable extent, the responsibility for fulfilling those hopes, by successfully accomplishing a major changeover in motive power—in short, by making dieselization work—rests upon your sholders. Your task here, I believe, is basically one of employee relations.

Failures Experienced in Diesel Operation

Two reports were presented on this general subject, one dealing with avoidable delays and the necessity of eliminating them, presented by W. H. Fortney, chief road foreman of engines, New York Central, and the other on how to meet operating difficulties on the road, whether they are avoidable or not. This was presented by W. H. Powell, supervisor of locomotive operation, Baltimore & Ohio.

Mr. Fortney presented 56 cases of complete failures or of delays varying all the way from a few minutes to six hours, gathered from various railroads. All could have been avoided or at least the delays could have been greatly reduced if proper inspection of the locomotives had been made at the terminal or by the crews when they took over, or if the crews had been up on trouble shooting.

Nine of the 56 cases were fuel failures, three because crews either did not know that the emergency cut-out had been tripped, or else did not know how to reset it; three because fuel-pump switches were open and all engines were ultimately killed in checking control fuses. One crew ran out of fuel, and on another locomotive the fireman put water in the fuel tank.

Steam-heat failures is another large group, with six instances described. Three were due to faulty steam-generator operation, two due to admission of steam to the train line too rapidly, causing loss of water, and one to a closed end valve in the train line between locomotive units.

Other classes of failures of which from two to five instances are reported are: engine starting contactors stuck (in some cases causing a complete discharge of the battery before being discovered); failures caused by the operation of ground relays because the crews did not know how to reset the relay; reverse and transition levers in wrong position on one unit, which would have been discovered if an inspection had been made by the crews when they took over; engine cooling system failures—crews were unable to deal with the manual controls of fans and shutters when the automatic controls failed; brake system failures; blown fuses; defective throttle operation, in one case because a bottle of governor oil was left where it blocked the movement of the throttle operating rod; isolation switches in wrong position; control-circuit jumpers loose, and control air pressure low. In most cases the failures or delays were not

caused by the conditions named but by the inability of the crews to find and correct the conditions promptly.

In his report, Mr. Powell described four cases in which difficulties developed on the road and in which prompt and effective action by the crews prevented them from causing delays.

The load ammeter on a locomotive hauling a passenger train at 80 m.p.h. suddenly went to zero and the engineroom became completely silent—all power was off and the steam generator dead. This was diagnosed as an emergency fuel valve tripped. This was reset and no further trouble experienced.

The water line between the engine jacket and the intercooler on a locomotive hauling a freight train split, caused a serious leak. The fireman shut the engine down and at a water stop the road foreman patched the leak with tire tape. No time was lost.

The locomotive hauling a passenger train would not respond to the throttle in the forward unit beyond the third notch. The road foreman operated the power with the throttle in the rear unit on signals from the fireman in the forward cab. The engineman operated the brakes from the front end and there was no time lost.

With a sudden drop in speed of a three-unit locomotive hauling a freight train the circuit breaker in the control circuit operated. With throttle in "idle" the circuit breaker could not be reset. The head brakeman discovered smoke and flame coming from the rear unit. The fireman went back, removed the jumper cable from between the second and third units, did not try to enter the third-unit engine-room, but took to the ground on the right side. In the meantime the engineman has gone back and pulled the emergency fuel shut-off valve. The fireman then entered the cab through a side door, crawled to the battery switch and opened it. Doors were then opened to clear out the smoke and the fire put out in two minutes with extinguishers. The reverser in the rear was blocked in neutral, the dead-engine device set and the run completed with power from the remaining two units.

Discussion

In cases where water is lost from the engine cooling system expansion tank because of inoperative shutters the Baltimore & Ohio can transfer water from the steam generator supply to the cooling system en route. This cannot usually be done on freight locomotives except where they are equipped with steam generators as is the case on the B. & O. To prevent freeze-ups in the air system this road introduces alcohol in predetermined amounts according to temperature on the discharge side of the air compressor. On locomotives where the fans are operated automatically a check of the relays determines whether or not they are operating properly. This check is important in climates where air temperatures are high.

The Frisco does a considerable amount of towing diesel locomotives at some seasons of the year in balancing power and has found that there are nine operations which have to be carried out to condition the locomotives for that kind of movement. The results have been found to be bad if these operations are neglected.

The problems of training men were brought up again in the discussion of these papers, particularly the difficulty of getting the men interested in the material and instructions available for them. One point was stressed that in introducing new men to diesel operation their confidence in their ability to handle these locomotives must be built up. The New York Central endeavors to have their engine crews sufficiently familiar with the diesel locomotive so that they can make up intelligent work reports. The B. & O. has now developed several question and answer books on the diesel. These are used by the firemen in preparation for promotion and are subject to revision from time to time.

In connection with the rules requiring the fireman on passenger trains to remain in the cab with the engineman at all times while the train is in motion, the New York Central has given attention to training the men so that they will have a thorough understanding of the alarm system. This training is said to have been effective in causing suitable action to be taken in emergencies.

One factor in correcting operating difficulties on the road and in keeping maintenance in hand which was mentioned in the discussion was teaching superintendents, trainmasters, yard masters and yard clerks that diesel locomotives must not be overloaded.

Steam-Locomotive Fuel Oil Combustion Studies

Most of the fuels used for motive-power steam generation fall under the grade-six designation of the United States Department of Commerce. These correspond to specifications for Bunker Oils. In general, fuels will range as follows: carbon, 80 to 87 per cent; hydrogen, 12 to 15 per cent; sulfur, 0 to 5 per cent.

Specific gravities will range from .90 to 1.05 or in corresponding A.P.I. gravities from 25 deg. to 3 deg. The heating values will range from 18,250 to 20,000 B.t.u. per pound. Since the percentage of carbon in the fuel in general increases with high specific gravity and since the pounds per gallon of fuel increases in the same direction, the heavier the fuel that can be handled, the higher its heat value per unit volume and the greater efficiency and power load can be obtained from a unit volume of fuel.

There has never been a unified program for perfection and improvement of the oil burner. Each railroad had its own ideas and many obtained successful and economical results. The Texas & Pacific held a leading position in fuel conservation among Class I railroads for many years.

During the latter part of the year 1946, the Southern Pacific began a program of research on combustion, to explore all phases of existing practices and improve the efficiency of their oil burning steam locomotives. Participating in this program were the Southern Pacific's Pacific Lines (Lines West of El Paso), T&NO Lines (Lines East of El Paso), and the Battelle Memorial Institute, a research foundation in Columbus, Ohio.

Engine No. 4401 was selected for these tests because it was representative of the more modern type of locomotive construction on the Southern Pacific. It is a 4-8-4 type locomotive, equipped with feedwater heater, booster, Type E superheater units, front-end throttle, power reverse gear and Walschaert valve gear. It has two simple cylinders with 12-in. piston valves, 30-in. cylinders, and carries a boiler pressure of 250 p.s.i.

No special grade of fuel oil was used in these tests. Oil was taken as needed from the regular supply of fuel oil at whatever location the engine was serviced.

The program was conducted in three major steps, as follows: (1) basic road tests with dynamometer car; (2) standing tests in test plant at Sacramento, Cal.; (3) confirmatory road tests with dynamometer car.

The basic tests were made under actual operating conditions on the road in both freight and passenger service. Several different combinations of oil-burning arrangements, exhaust-nozzle splitters, and smoke-box arrangements were tested. The Battelle Memorial Institute made scale-model tests in the Columbus research laboratories using various data obtained from basic tests, to determine what modifications could be made in existing standards on the locomotive firebox and smoke box, to improve air flow. The basic road tests established operating characteristics of No. 4401 and the data obtained was used to correlate actual operating conditions with standing-test conditions in order to evaluate the results properly.

The standing tests followed the basic road tests. The engine was placed in the test plant especially constructed and instrumented for this research program at the Southern Pacific's Sacramento shops. The standing tests were made with various oil-burning and front-end arrangements. Several types of firepans

and numerous designs of burners were tested, including multiple application of precision-type burners used in stationary boiler service, rotating-cup burners, and various designs and modifications of railroad burners currently used. Burner location and method of air admission were varied to determine optimum performance. The exhaust-nozzle opening was varied; several types of nozzle splitters were tried out. A larger-diameter smoke stack was employed. The information and data obtained led to changes and modifications in existing standards that definitely improved combustion and overall performance.

The final phase of this research program was the confirmatory road tests. Engine No. 4401 was equipped with the improvements developed in the Sacramento standing plant and road tests were made in passenger and freight service under actual operating conditions, similar to the basic road tests. The confirmatory tests proved in actual road service the results obtained in the standing tests.

Improvements developed by this research program include the application of a more efficient gyrojet tubular-type oil burner, better design of firepan, improved drafting arrangement, larger smoke stack and exhaust nozzle, improved firing valve, reduction in heat losses by additional insulation, more effective bricking arrangement, use of top boiler check, removal of obstructions from smokestack, improved oil-tank heater, and better sealing of smokebox. Based on confirmatory road tests made with the locomotive equipped with the above improvements as compared with the basic arrangement, it was found that an overall average fuel saving of eight per cent can be realized with the improved arrangement on the type of locomotive tested.

The nature of this association gives us an excellent opportunity to further similar progress. We must do everything we can as an organization and as individuals to eliminate waste and institute new methods of fuel oil conservation.

The report was presented by T. J. Conway, fuel supervisor, Texas & Pacific.

Discussion

Much of the discussion centered around nozzle tip sizes. While most of it dealt with oil-burning practice, some comment referred to coal. Both the Goodfellow type nozzle and the basket-bridge type have their advocates, the latter being perhaps the more popular of the two. While there was some difference of opinion as to whether nozzle tips on oil-burning locomotives should be larger or smaller than those on coal-burning locomotives of the same size, experience of some roads which have made tests is that only by experimental proportioning of the interrelated dimensions of the front end can the nearest to smokeless combustion and the highest fuel efficiency be attained. In answer to a question, it was brought out that the Great Northern, which began its oil-burning experience in 1911 with all obstructions removed from the smoke box, had obtained improved combustion by restoring the draft plate. Another factor considered of importance in securing efficient combustion and absence of smoke is a tight front end absolutely free of air leaks. Properly aligned burners are also important.

Proper temperature of the oil as it is fed to the burner was stressed as an important factor in producing good combustion. From 150 to 180 deg. was mentioned as being a good practicable working range. On the Great Northern thermometers have been put on the locomotive in some cases as an aid to the fireman.

The Storing and Dispensing of Diesel Fuel Oil

The methods used in the unloading and disbursement of diesel fuel oil are quite generally the same on the railroads checked.

A sample of oil is secured from each car for analysis to be checked with specifications before the oil is pumped from the tank car to the service or storage tank. It is the general consensus that the best practice in handling diesel fuel oil in storage is to unload all tank cars into the storage tank and then fill service tanks, when used in conjunction with storage tanks, or make deliveries from the storage tank. In this manner, the stock is kept moving and in cases where summer and winter grades of diesel fuel oil are purchased, it will permit the transition from one grade to the other. This handling would also eliminate almost entirely any possibility of deterioration of diesel fuel oil that might occur while standing for long periods in storage tanks.

Some unload from the dome while others unload from the bottom valve, depending on how their facilities are equipped. The oil is filtered or screened into and out of storage tanks. Some points also meter in both ways, but the reading into the storage tank is used only for the purpose of determining quantities in the cars as a comparison with quantities invoiced. In all cases of unloading, cars should be thoroughly drained to remove any condensation or foreign matter that may settle in the bottom before they are returned to refineries. They should then be inspected again to make sure that the cars are absolutely clean. They must be inspected frequently to eliminate leaks at bottom outlet connections, and also for leaks around rivets and seams.

Some loss has been encountered due to leakage of underground oil lines running from storage tanks to fueling stations. When a leak develops the loss is considerable before it can definitely be located. The expense involved in correcting it is also quite heavy. This raises the question, should diesel fuel oil lines from storage tanks to fuel racks be underground or above ground, considering the effect of freezing weather.

Frequent inspection of and good housekeeping at diesel oil facilities pays good dividends in fuel conservation. Any leaks must be corrected as soon as discovered.

Cleanliness in the handling of diesel fuel oil must be emphasized and periodic examination of the contents of storage and service tanks should be made in order to determine when these tanks should be cleaned or have sediment and water removed. Water and sediment may be removed by water draw cocks placed in the bottom of tanks, or by siphoning or pumping through pipes placed so as to draw from the bottom. Water can be detected in the tank by the use of cobalt solution which gives a color indication. Diesel fuel oil storage tanks on some roads have been in service for several years without being emptied for cleaning.

It is suggested that additional storage capacity be provided in order to insure an adequate supply of fuel on hand in storage tanks at fueling stations at all times, also to permit prompt unloading and release of tank cars which are in short supply and will, no doubt, continue to be throughout the present emergency. Some railroads are converting residual fuel oil storage tanks, while others will have storage tanks available that have been used as water treating plants no longer required under dieselization.

Fueling the Locomotives

The greatest consideration should be given to fueling of the diesel locomotive to avoid waste that is involved by spillage and overfilling of the fuel tank, for which in most cases it is found that the human element is more responsible than any other condition. Generally, the facilities on the railroads are installed and equipped for the fueling of four units in the one spot of the locomotive, this however does not mean that the flow of oil is made to all units at the same time. The number of units fueled at the same time is largely determined by the number of men doing the work and the capacity of the pumps to supply the oil. One man cannot always control the oil flow to four units without some cases of overflowing the tanks, especially if he is also supplying water to the units in the same operation. For that reason, some points restrict fueling to one or two units at the same time in order to control the high rate of flow by closing the valve at the rack to shut off the pressure in sufficient time to permit as much draining of the hose as possible before the nozzle valve is closed and the hose disconnected.

At intermediate terminals, where passenger and fast freight locomotives are fueled and the "dead time" is short, more units

must be fueled at the same time to avoid excessive delays. Some roads have recommended the use of the automatic nozzle, although some change would be required on the channel between the fueling connection and the tank proper, and on the strainer of some types of locomotives. It has been suggested that consideration be given by diesel locomotive builders to having fuel-oil fill openings installed in fuel tanks with 10 or 15 deg. upward bend, so that supply hoses can be completely drained into the fuel tanks on the locomotive. With the present arrangement, on most passenger and freight road locomotives, it is not possible to drain the supply hoses because the fuel fill openings come straight out of the tank.

Some roads are now testing the Ventalarm signal that whistles until the tank is filled, to eliminate overflow spillage.

No provisions have been made at a number of fueling stations or oil racks to catch the spillage. They are not equipped with trough or cement apron with proper drains to recover the oil for other use, and various types of containers are used in an attempt to catch what oil they can. Some have equipped the riser standards with drip boxes in which the hoses are placed. These boxes are equipped with drain valves in the bottom and the oil is drained out and reused.

Fuel Wasted in Idling

A considerable amount of fuel oil is being consumed by unnecessary idling of diesel locomotives, especially in warm weather when it would be possible to shut them down for sufficient periods of time to warrant it. Tests were made showing that a 600-hp. diesel switch engine consumed 3.75 gallons of oil per hour and a 1,000-hp. diesel switch engine consumed 5.71 gallons per hour idling. Freight and passenger diesels with greater horsepower would use a proportionately larger amount of oil per unit than the switch engines.

As far as fuel statistics are concerned there is a great variation as to the equation factor being used in making comparisons between coal and diesel fuel oil when arriving at unit consumption in pounds per 1,000 gross ton miles (including locomotives and tenders) in road freight service based on equated pounds of all fuel used according to what each road indicates is applicable to its local conditions. As taken from reports March, 1948, for 57 railroads they show a maximum gallons of diesel fuel oil equivalent to one ton of coal of 194.5 in all services and a minimum of 20 gallons in freight service, 16 gallons in passenger service and 12 gallons in switch service.

In freight service the reports show that 12 railroads use between 20 and 30 gallons to one ton of coal; 23 roads, 30 to 40 gallons, 10 roads, over 40 to 50 gallons, and 12 roads, over 50 gallons.

This report was presented by O. D. Teeter, fuel supervisor, Denver & Rio Grande Western.

Discussion

In reply to a question as to whether any effort had been made to standardize conversion equivalents for oil to coal Mr. Teeter said that the Bureau of Railway Economics had prepared statistical reports on unit fuel consumption in terms of each of the three types of fuel in each class of service for 1949 and 1950, which he considered better than equating into terms of coal.

The discussion dealt mainly with the question of how long a locomotive should be allowed to stand at an engine terminal with the engine running. The average cost of diesel fuel in June on the Baltimore & Ohio was quoted as 10.25 cents per gallon and the management is becoming conscious of the need to conserve it. Leakage is another source of considerable loss. At Chillicothe, Ohio, a loss of 20,000 gal. of oil through leaks in underground oil lines has raised the question as to whether the lines should not be placed above ground.

Several rules for idling during stand-by were mentioned. The Missouri Pacific has a one-hour idling rule effective when the weather is not freezing. The Great Northern allows engines to be idled when tied up over night unless there is a source of heat for the cooling water. This prevents water seals from leaking from the contraction and expansion caused by shutting down and starting up. On road power, when it is evident that there is going to be an extensive delay on the road, instructions are to shut down one unit at a time and alternate them. At terminals the engines are operated just long enough to warm them up, say about 30 minutes before they will be used.

The opportunity to keep accurate fuel records on diesel locomotives was stressed. The fuel can be metered and if each outlet has a meter there need be no guess work as to the fuel consumption on each locomotive.

Education of Locomotive Operating Personnel

With the transition from steam to electric and diesel-electric power on the railroads of today, the proper education of locomotive operating personnel assumes a new importance. The conversion brings before each of us the responsibility of changing in a few short months practices that have been in use from the very beginning of the railroads—practices that are more of a liability than an asset in the operation of the modern equipment.

Diesel Instructions

When it is definitely known that diesel power is to replace steam power a course of preliminary instruction should be started immediately. This begins the ground work so the operating personnel will have a true picture of what the new power means to them. To the average locomotive crew the new equipment is mysterious and its operation too complicated to be readily understood. The preliminary classes should accomplish much toward dispelling these ideas.

After the new locomotives arrive and the crews have made several trips under competent instructors they become more interested and the time is now appropriate to set up a permanent program of training and instruction. As the program progresses some inducement is necessary to keep their interest, and the easiest way is to add variety to the classes. The use of visual aids in the form of projection slides and motion pictures of the equipment and its operation can explain more thoroughly in a few minutes than several hours of lecturing.

The most important instruction is that given on the job under actual operating conditions by the supervisors, and it must be uniform in its application to be successful. A common practice prevails that when one group learns their job they pass their knowledge along to another, and if they do their job the wrong way the others following will do the same. A careful check must be kept to see that a uniform standard is maintained.

Selecting New Men

The most important step in the building of a well-trained and efficient personnel is the selection of proper material at the time of employment, as the fireman of today is the engineman of tomorrow. The employing officer should require well supported references as well as make a study of the personality of the applicant to satisfy himself that he is the proper material for employment and—later, for promotion. The employment officer should talk with the applicant to ascertain whether he is seriously considering making railroad work his lifetime career.

The successful applicant should be between the ages of eighteen and twenty-five; should have a high-school education; be of good moral character and willing to study and apply himself. After passing the necessary physical examination he should be given a rule book and timetable, and should be carefully instructed in the duties and responsibilities of his job. He should also be given a preliminary course in Safety First and first aid, and should be impressed with the importance of attending the various classes of instruction in these and other branches of training. He should then be given a permit, after which he should be assigned to one

of the best operating crews on the division for his student trips.

In making the selection of an operating crew for the instruction of a student fireman the road foreman of engines or a supervising officer should choose from among the older members of the service a crew which has not only the knowledge but the ability to impart that knowledge to the students. Many operators who are thoroughly efficient in every particular themselves, lack the ability to impart their knowledge to others. The same rule applies also to the selection of the supervising personnel.

The First Oral Examination

After the student fireman has made his required number of trips and has demonstrated his ability to learn and to apply himself as he should to the crew or crews with which he has ridden, he should be given an oral examination covering what he has been taught, questioned as to his knowledge of the rule book and special instructions, coached in the proper method of flagging the front end of his train when necessary, and instructed as to how to conduct himself so as to prevent personal injury as well as injury to others. He should also be instructed as to the use of supplies and equipment entrusted to his care, and impressed with the fact that he should perform his duties and take an interest in his work, just as though he was working for himself.

Usually he is now marked up on the extra board preferably on a yard engine for awhile. A traveling fireman or road foreman should, if possible, make the first trip or two with him to give him confidence, to see that he gets started off with the right ideas, and to encourage him to look to his engineman for instruction and guidance when confronted with some problem that he does not understand. Some supervising officer should then ride with him once in awhile to see that he does not acquire improper ideas or practices.

The supervisor should know by the time the fireman stands for promotion to engineman just about what kind of an engineman he will make. On our road we do not object to the fireman handling the engine under the supervision of the engineman, although the engineman is held responsible for the fireman's performance. Consequently, most of our young enginemen start running with a fair general idea of their duties and responsibilities. However, unless we know that he is well qualified, we make the first few trips with him, then make an additional trip from time to time to see that he thoroughly understands and carries out his instructions, and handles his engine and train in the proper manner.

We encourage the teaming up of enginemen and firemen who like to work with one another, when seniority rules permit. Our working rules permit assignment of regular men in yard, freight and passenger service, and it is not unusual for an engineman and fireman to stay together on an assignment, even when one or the other stands for a better job.

Teach the Facts of Industrial Life

Years ago the sense of loyalty, gratitude, and pride of position seem to have been a quite general and inherent part of our employees' make-up, but modern political and economic conditions have influenced many people to feel that the country owes them a livelihood. This attitude is destructive, both to the employee and to the employer, and must be nullified by education.

The new man must be thoroughly convinced of his obligation to the railroad and of his responsibilities. He must be impressed with the very large investment made by the railroad stockholders so that he may have the means of earning his livelihood. This feature is too often overlooked. Vigilance and safety must become an ingrained part of the operating employee's mentality. Only a well-directed instruction and a sensible presentation of facts and precedents will create, in many cases, this cooperative interest.

It must be recognized that the welfare of the employee is largely dependent upon the prosperity of the railroad. Economy in the handling of materials and protective care of equipment are indications of an employee's interest. This idea should be incorporated as a part of the educational program.

The diesel locomotive as compared with the steam locomotive requires much less arduous effort and allows more comfort of operation. These facts should tend to further increase a cooperative interest.

The report was presented by G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac.

Discussion

A series of questions and answers brought out differences in the practices on the R. F. & P. from those on many other roads in the matter of training, examining and promoting firemen. Firemen are not given progressive mechanical examinations, with promotion on passing the third at the end of three years, but are examined in groups in anticipation of the need for promoted men. The examinations are given and judged by the road foreman or his assistant and are both written and oral. The road foreman is entirely responsible for the hiring and promotion of firemen.

There was considerable discussion of methods of training men in the locomotive service in the operation of diesels, but a question as to the preparation of diesel firemen for promotion and as to what kind of mechanical examinations they are given brought out no information. Mr. Curtis said that the next group to be examined on the R. F. & P. would probably be given a diesel examination but it had not yet been formulated.

Questioned as to what methods he used to create some enthusiasm among the men for the study of the diesel locomotive and its operation, Mr. Curtis said that, when they bought a group of road engines, they rented a car and tried to give the men a few fundamentals so they could start and stop the engines. Then followed instruction pamphlets and, with some extra supervision, in about 90 days the men were running diesels. They were taken from 75- to 80-car freight trains and put on diesels hauling 160-car trains. They ran them but were not very efficient. Then, without a car, instruction was continued with a projector and slides and a few parts important in the control of the locomotive. Round table discussions were organized the subjects of which were the problems posed by the men themselves. Those who fail to attend classes or discussion groups are reminded tactfully when they get into trouble and cause a delay that classes are being held, which usually produces favorable results. A record is kept of all delays and these are written up as case studies every two or three months and distributed. They offer opportunity to call attention to men who have done good jobs in emergencies. About the only electrical instructions the men are given is how to check for a fuse failure.

Water Treatment—Steam and Diesel Locomotives

In steam operation the largest single material supply from a tonnage standpoint has been water. The various sources of supply have presented many problems of quantity and quality. Progress from the earliest days of small saturated steam power to the present high pressure superheated power has been a miracle of power evolution. This evolution has demanded and received a similar evolution in water treatment to provide the constantly increasing effectiveness required. This has been met in various ways as our knowledge of water treatment in chemistry grew.

The benefits from water treatment on our various roads have been parallel with the soundness of the fundamental knowledge of water treatment, close supervision and the accuracy of chemical application. These factors apply to diesel power as well as to steam power and will continue to be vital in the future development of any prime source of power requiring the use of water.

Many of our roads are changing from steam to diesel power. This change necessitates a constant revision of steam operating practices. Practices on each road, even each division, must be

constantly reviewed on the basis of its individual power operating conditions.

Water for Diesels

As long as steam power is operated it presents the choice of either efficient or wasteful operation. Some of the points requiring consideration during such power transition periods are maintenance of interest in efficient steam operation during the period when diesel power is being inaugurated, maintenance of high standards of treatment to prolong boiler and flue life, maintenance of clean boiler heating surface to secure efficient fuel performance, closer attention to foaming concentration buildups incident to longer terminal layover periods, increased tendency to sludge and mud accumulations incident to intermittent operation, reduction in frequency of recharging treating plants incident to reduced volume of water consumed and reconsideration of the desirability of using live steam to maintain boiler washout-plant temperature. Each case must be acted upon strictly on the basis of local operating conditions.

In the early days of railroad diesel operation, the manufacturers gave little if any consideration to water treatment. Experience soon exposed this tragic oversight—the three major water problems, corrosion, incrustation and foaming, were exacting a prohibitive toll by overheating of incrusted water cooled parts, corrosion of water surfaces, burned-out generator coils, fuel waste and failures. The manufacturers, chemical companies and railroad watermen searched for the answers. Under the able sub-committee chairmanship of M. A. Hanson, research chemist of the Gulf, Mobile & Ohio, the American Railway Engineering Association Committee 13 developed, compiled and published sound effective standards of treatment for diesel water. This information is available to all. Time tested field operation under such standards of treatment are positive proofs that excessive corrosion of water-contacted metals can be controlled, incrustation can be prevented and foaming eliminated.

Typical of such treatment is the history of steam generators on the first six diesel passenger locomotives purchased by the Frisco. Two failed because of defective coil installation. Four are still in service with the original coils after approximately a million miles of service, including heavy summer operation for steam-activated air conditioning. During the four years coils were de-scaled when excessive pressures indicated need for cleaning. This occurred on an average of only once each seven months for the entire group during the four-year period.

The water engineers and chemists on your respective roads have extensive knowledge of the characteristics of your various water supplies and practical experience in design and operation of proportioning equipment to meet effectively the new problems.

The huge investment by our American railroads in diesel power and the ever increasing standards of dependability demanded of diesel power and steam generators justifies plant control of water treatment on an exact basis if we are to accomplish the savings possible with this type of power. While the volume of water used and the tonnage of chemicals required is small compared with steam-boiler water treatment the cost per pound in many cases is much greater and only by effective plant control can the cost be kept down. Manual application of chemicals for water treatment of diesels is wasteful of chemicals, invites irregularities and requires expensive control and supervisory tests to secure even partial results. To continue extensive manual application means that you are disregarding a major portion of the progress made in perfecting the practical application of water treatment.

You have heard much about preventative maintenance. Its necessity under present operating conditions is admitted by all. Water treatment is the perfect example of real preventative maintenance. Operation of modern steam or diesel power without effective water treatment is economically unsound, if not actually impossible. Good operation is efficient operation. Effective water treatment, or lack of it, can well be the deciding factor in efficient motive power operation.

This paper was presented by I. C. Brown, chief water engineer, St. Louis-San Francisco.

Discussion

In answer to a question Mr. Brown said that the separator is blown down every half hour in the worst water territory and once an hour elsewhere. It is the practice on the Frisco to shut down the steam generator and back flush the coils at each division point. Under the present agreement which requires two men in the cab while the locomotive is in motion, the fireman cannot go back to perform this operation approaching the end of his run and the outgoing fireman cannot do so because the engine is in the station. But it is done at each end of the locomotive run, the longest of which is 541 miles.

Experience on the Burlington is that dependence on individuals for the right kind and right amount of treatment is not satisfactory. Since demineralizing plants have been established at the major water stations the extended life of coils has been considerable. Corrosion took place in the first six turns of the outer coil. The separate economizer coil in the Vapor 4625 plant permits replacement where the corrosion takes place without cutting off and replacing part of the coils as was the practice with former heaters. If the main terminals have treated water Mr. Brown said that the amount of untreated water taken in emergencies was not likely to be enough to cause trouble. It was also brought out that, where a cooling system is known to be leaking, the tank can be filled to the required level with the engine running, which adds 10 or 12 in. of water more than would be taken if the engine were not running. This helps to reduce the amount of water which must be taken at intermediate points during the trip.

In closing, Mr. Brown emphasized the importance of accurate water treatment, which is more than justified by improved performance and reduced maintenance, as well as by economy in the treating materials used.

Steam-Locomotive Coal Economy and Availability

This report pointed out that coal takes in such a range of quality, availability and ultimate efficiency that it is impossible to formulate a purchasing policy other than "the greatest ton-mile production per dollar of fuel expenditure." When commercial demand equals or exceeds the production of the well equipped coal mines it is difficult to purchase the coal desired. When possible, it is good business to encourage the development of coal mines which may benefit the road's traffic and general business conditions along the line.

The availability of a steam locomotive begins at the main shops and continues on through all roundhouses. If it is to be operated efficiently it must be operated with a minimum of delays and failures. To avoid failures strict attention must be given to its mechanical features and to the coal used. Poor steaming locomotives waste fuel and cause failures on the road.

A cold-water method of cooling down locomotive boilers in the roundhouse was described by which roundhouse detentions may be reduced, the life of firebox sheets prolonged and the mileage between tube renewals increased. This needs a cold-water line and a blow-down line and hot well in the engine-house and a cold-water inlet connection on top of the boiler at the front end and a hot-water and steam blow-down connection on or near the dome. The boiler is filled with the injector until it breaks and then the filling is continued through the cold-water line, water being drawn off through the blow-down line. When the boiler is cooled down sufficiently so that the back of the hand can be held comfortably against the firebox sheets the cold water is shut off and the boiler drained through the blow-off cocks. The time required to cool down a boiler by this method after it arrives in the house until it is ready for washing varies

from two and one-half hours for small power to four hours for large power. This method prevents baking scale and mud on tubes and firebox sheets, so that it can be easily washed off. The average life of firebox sheets on the railway employing this method is as follows:

	years
Crown sheets	20 to 25
Tube and door sheets	8 to 12
Side sheets	6 to 10

Drafting and Steaming

The Northern Pacific has eliminated from the front end all possible restrictions to the flow of gases to the stack. This has permitted the area of the nozzle tips on some classes of power to be increased. Instructions are that no changes shall be made to nozzle tips whatever. When a locomotive is reported not steaming it must be taken out of service and the defects found and repaired before it is placed back in service.

To make it possible to burn lignite coal, which tends to expel many sparks, the Cyclone front end was adopted some years ago for all coal-burning locomotives. Although it has given good results, it is now being replaced by the Cannon type as spark arresters need renewal. It works on the same principle as the Cyclone.

Ash Pans

The Northern Pacific has gone to considerable expense during the past few years to prevent sparks from escaping from ash pans. Lignite ash is very fine and will sift through very small openings and any unburned small pieces of coal which shift through the grate will stay in a slow-burning condition for a long time, requiring the ash pans to be kept in the best possible condition. Ash pans with two or more hoppers are being redesigned and one hopper eliminated. Lifting-type hopper doors have been replaced by the radial type and a ⅜-in. iron rod was welded to the inside of the bottom of the hopper walls to make a tight fit when the door is closed.

All pans are tested with water at each locomotive monthly test or whenever sparks are reported escaping from a pan. All fires are investigated and many times are found to have been caused by the engine crew not shaking a small amount of ash down in the pan, then wetting it with water through the swipe pipes, to provide a tight seal, after the pan has been emptied.

Air deflector vanes are installed between the ash pan coping and the boiler leg at both front corners of the pan. These scoop up some air at high speed and prevent syphoning of sparks out of the pan at the front corners. After applying deflector vanes to ash pans, one road reported more uniform combustion over the entire grate area and that it was possible to increase the tip opening area.

Coal

Screening tests indicate that mechanically mined 5-in. by 0, the size long used with stokers, now contains about twice as much ⅜-in. by ¼-in., ¼-in. by ⅛-in., and ⅛-in. by 0 sizes as did this size prior to mechanization. This adversely affects locomotive operation and efficiency. Tests have indicated that a bottom size of ⅜ in. is generally desirable for stokers. Experience has demonstrated that double-screened coal will increase the availability of the locomotive and reduce the cost of handling coal and ashes. One test shows an increase of 7.14 per cent B.t.u. value of 2½-in. by ¼-in. as compared with 2-in. by 0 coal from the same mine, a decrease of about 19 per cent in ash, and that about 1¾ in. is a desirable top size for stoker coal. It would seem to be practicable to specify about a 2-in. by ⅜-in. nut when such a size is readily obtainable. It is preferable if possible to avoid the use of the stoker as a crusher.

This report was presented by C. M. Moddrell, supervisor of fuel and locomotive performance, Northern Pacific.

Train Handling—Joint Session with Air Brake Association

The subjects of train handling, passenger and freight, and dynamic braking have been so thoroughly covered during recent years that any statement or suggestion would be a repetition. Therefore, it was decided to make a study of the methods and practices of train handling employed on the different railroads. Instruction pamphlets from approximately 50 per cent of the Class I railroads were available for our study.

Starting

Generally speaking, the instructions of all railroads are in accord that the engineman of the lead locomotive of a double header should take up all slack and start the train unassisted if possible. With freight trains, speed should be low for a distance of at least 200 ft. to allow slack to be taken moderately on a long train.

Service Braking

The method of handling during service braking is not exactly the same on all railroads when establishing a brake application on a train that is in motion. In freight service, some roads insist that power, or a pulling throttle, must be used. Run-8 throttle position of the diesel locomotive is advocated by some, while others insist on the throttle being reduced to run-3 position. Some advocate a 5- to 7-lb. initial reduction when handling long freight trains while others suggest a 7- to 9-lb. initial reduction. A similar difference in the methods of handling passenger trains exists on different railroads.

First service position—The use of first service position to establish the initial reduction on long freight trains appears to be very popular with most roads, which signifies that all recognize the advantages to be derived from the rate of brake-pipe reduction imposed and the maintaining feature.

Stopping Freight Trains

With one exception, all are in accord that the proper final reduction must be made with a discharge of air at the service exhaust as the stop is completed on a freight train that is being stopped during a forward movement. Likewise, all agree that, when stopping either a freight or passenger train in backward movement, the brake application on the train should be very light, consistent with grade and other conditions. The locomotive brake should not be permitted to apply during the brake application and a light pulling throttle should be used until just as the stop is completed.

Spot stops—Our study of the instruction pamphlets reflects that some roads require spot stops to be made with the locomotive brake alone. Some leave it to the judgment of the engineman, while others prohibit the use of the locomotive brake alone for making spot stops on passenger trains. There appears to be no serious objection to making spot stops with freight trains with the locomotive brake alone, where conditions are favorable for such handling.

Controlling train slack—One railroad does not permit attempting to brake a freight train of 75 cars or more with slack stretched. Apparently, others leave this to the judgment of the engineman.

Stopping Passenger Trains

As a rule, the instructions of all roads provide for the one-application, graduated-release method of stopping passenger trains, with provisions for the two-application stop under certain conditions. Most roads suggest that the stop be completed with light or no brake-cylinder pressure, while one road requires passenger-train stops to be completed with light brake-cylinder pressure on train and locomotive.

Releasing

It appears to be the consensus of opinion that a reduction in brake-pipe pressure of at least 12 lb. should be made on a freight train of 75 cars before a release is made and that two minutes should be allowed for brakes to release before attempting to start. Most all are in accord that graduated release on passenger trains should not be made if the total brake-pipe reduction is not at least 10 lb.

Brakes Applied by Other Than the Engineman

With one exception, all roads require the throttle to be closed and automatic brake valve placed in lap position immediately when train brakes are applied in emergency. The instructions of one road provide for the brake valve to be left in running position during the stop of an emergency application. Also, there is a radical difference in the instructions for handling when train brakes are applied in a service application by other than the engineman. The instructions of some roads provide for the brake valve to be left in running position, throttle to be gradually reduced as train speed reduces, and when approximately 100 ft. from stopping point the throttle is to be closed and locomotive brake fully applied. To place the brake valve in lap or service position would probably cause brakes to apply in emergency, according to their views. The contrast is the road that requires the throttle to be reduced to a light pulling position as soon as the brake application is observed, to fully close the throttle and apply locomotive brake 500 ft. in advance of the stopping point, and when within 200 ft. of the stop, brake valve is to be placed in service position and left there until stop is completed.

The radical differences in the instructions are sufficient to invite a discussion of the subject.

Dynamic Braking

It has been proved that a tremendous saving in wheel and brake-shoe wear can be effected by the proper use of the dynamic brake. Our study indicates that very few roads use the dynamic brake in freight service and all those using this brake for controlling train speed in freight service do not make use of it for controlling speed of their passenger trains. It has been stated that the dynamic brake has many possibilities. The writer is in accord with that statement.

Respectfully submitted for your consideration and with the hope that during your discussions something will be said that will contribute to the program for improved and better train handling.

This survey was presented by T. H. Bickerstaff, general supervisor of air brakes, Atchison, Topeka & Santa Fe.

Discussion

This survey was presented by T. H. Bickerstaff, general supervisor of air brakes, Atchison, Topeka & Santa Fe.

the rear end of the train in effect on the M.-K.-T. and other roads, it was explained, originated as the result of tests conducted on the New York, New Haven & Hartford about 1923. It was found in these tests that under certain profile conditions, lapping the brake valve produced undesired emergency brake applications which frequently caused break-in-twos. It was also evident that, in handling long freight trains, lighter initial brake-pipe reductions than are mentioned in the report are considered necessary by a number of roads and that subsequent reductions should also be of the order of 3 or 4 lb., a result accomplished by the first service position of the brake value. Examples of successfully handling trains of more than 150 cars by this method, including the use of the slack-stretching throttle, were cited.

The Frisco, on the other hand, limits the use of the stretching throttle to trains of 75 cars and less. On longer trains this road found that, with three-unit diesels, it was impossible to keep the train stretched because of the brake-pipe pressure gradient. The practice is to close the throttle, allow time for the slack to run in, then make a light initial brake-pipe reduction and increase the application in light steps up to the amount which can be released without stopping the train or tearing it in two at the final speed desired. In releasing the brakes on a long train with bunched slack the practice is to apply the independent brake to not less than 20 lb. before releasing the automatic brake and keep it on until the train brakes have released. Then it can be released gradually in 4- or 5-lb. steps. Further time should be allowed for slack adjustment before using power again.

The question was raised as to what happens to a train when braking with a full throttle if a bad triple valve or a bad feed valve should cause an undesired emergency. The only answer volunteered was that there are few triple valves left and that the AB brake is relatively free from undesired emergencies. It is the opinion of those who favor the use of the stretching throttle that most emergencies associated with break-in-twos and reported as "undesired" are the result of break-in-twos and not their cause; that the cause is a reversal of the slack in the train.

Cases of undesired emergency not accompanied by break-in-twos were cited on two roads. One has the emergency application on releasing the brakes after several applications have been made going down grade with the locomotive throttle in idling position. This also happens on the first application after the use of the dynamic brake and on both passenger and freight trains. No explanation has yet been found. Inadequate compressor capacity was suggested as a possible cause in the case of passenger trains. The other road has trouble when starting long freight trains after a stop. The emergency occurs whether the start is ahead or backward to take slack. This seems to be associated with cars on which vibrators have been used in unloading.

The Great Northern has made several tests of stopping trains from the rear end. With a train of mixed empties and loads the first test was made lapping the brake valve and gradually easing off the throttle. Two knuckles were broken. In the second test the brake valve was left in running position and the throttle handled as before. Three trial stops were perfect; on the fourth one knuckle was broken in the middle of the train. Tests were also made on ore trains, hauled by Mallet locomotives, which have 100 per cent AB brakes. On a train of empties with the brake valve in running position a knuckle was broken on the tenth car back. With the brake valve lapped trial after trial was made with no failures. With loads, running from 18,500 to over 19,000 tons per train, the train broke in two when stopping with the brake valve in running position. Since using the A1 caboose valve in the No. 2 position, and lapping the brake valve, there have been no break-in-twos.

In defense of enginemen and road foremen, who catch much of the blame for less than perfect brake performance, attention was called to a failure of management to change signal spacings to compensate for the slow brake application using the first service position of the brake valve, and to provide sidings with 30-m.p.h. instead of 15-m.p.h. turnouts. Both are critical factors in handling long freight trains with freedom from damage.

* * *



Checking wheels of the Southern Pacific streamliner "Shasta Daylight" during nightly inspection. Magnifying mirror gives enlarged view of any tread or flange defects which may be discovered

Car Men Hold Record Annual Meeting

Three-day sessions at Chicago emphasize the need for better lubrication and general car maintenance



J. A. Deppe,
President
(Superintendent car department, C.M.St.P.&P.)



W. N. Messimer,
Vice-President
(General superintendent equipment, Merchants Despatch Transportation Corp.)



F. H. Stremmel,
Sec.-Treas.
(Assistant to secretary, Mech. Div., A. A. R.)

FROM the point of view of attendance, quality of committee reports, discussion and addresses by leading railway executives, the three-day annual meeting of the Car Department Officers' Association at Chicago on September 17 to 19 was a record breaker At least 450 members and guests were present at the first session when President J. A. Deppe, superintendent car department, C.M.St. P.&P. delivered his opening address.

Speakers at the various meetings included J. P. Kiley, president of the Milwaukee; G. J. Willingham, director of personnel, Illinois Central; and A. L. Green, special representative, Freight Claim Division, A.A.R. The association was also addressed informally by F. K. Mitchell, manager of equipment, N.Y.C., New York and F. T. James, general superintendent motive power and equipment, D.L.&W., Scranton, Pa.

Committee reports were presented on Wheel Shop Practices, Chairman E. E. Packard, district master car builder, S. P., Los Angeles, Cal.; A.A.R. Loading Rules, Chairman A. C. Bender, joint supervisor of car inspection, Cleveland Car Inspection Association; A.A.R. Interchange and Billing Rules, Chairman J. J. Sheehan, supervisor car repair bills, M. P., St. Louis, Mo.; Air Conditioning, Chairman R. F. Dougherty, general electrical and air conditioning inspector, U.P., Omaha, Neb.; Analysis of Train Yard Operations, Chairman W. B. Medill, master car repairer, S.P., Portland, Ore.; Car Lubrication, Chairman K. H. Carpenter, superintendent car department, D.L.&W., Scranton, Pa.; Preparing Cars for Higher Commodity Classification, Chairman T. E. Hart, chief car inspector, N.Y.C.&St.L., Cleveland, Ohio; Testing Passenger Car Cleaning and Painting Materials, Chairman E. M. Driscoll, foreman painter, C.M.St.P.&P., Milwaukee, Wis.

Address by J. P. Kiley

J. P. Kiley, president, C.M.St.P.&P. paid tribute to car department forces and said that, although railway men in many departments contribute to train operation, rolling stock would not be on the rails at all without car men who are now faced more than ever before with the urgent need to find better ways of doing things.

He mentioned the intense competition confronting the railroads today and said that major efforts to give industry constantly improved freight service and passengers ever more speed, comfort and convenience must not be allowed to slacken, even if some railroad problems might be simplified thereby. For example, present hot-box difficulties are, no doubt, partially due to stepped-up speeds in freight service, and speed reduction would, of course, help reduce hot boxes, but this solution would be an admission of defeat and unthinkable to any red-blooded railroad man. Mr. Kiley remarked that, but for the efforts of conscientious car men, railroads would have even more hot boxes to deal with than at present, and yet these men, by more intensive servicing of plain-bearing journals, or other appropriate means, must do their full share to minimize hot boxes, now causing so many train delays, disrupted freight schedules and attendant costs.

Mr. Kiley mentioned the problems of car men in servicing and maintaining complex modern passenger cars, including air-conditioning equipment, which the public likes and hence must be kept functioning properly. He suggested that car supervisors continue their good work in maintaining car conditions which will minimize loss and damage claims, and closed his remarks with an earnest appeal for all car men to assist in railway public relations work whenever and wherever possible in their contact with shippers and the general public.

A. A. R. Loading Rules

The committee believes that most difficulties with open-top loads is not entirely the fault of current loading rules being inadequate, but more due to mishandling of the equipment in hump, switching, and train service. This results in delay to shipments, unnecessary expense to carriers for damage and adjustments of loads, not to mention dissatisfied shippers and receivers of freight with resultant loss of traffic to competitive modes of transportation.

Therefore, car supervisors should appeal to their operating departments to obtain cooperation by improved handling of open-top loads.

The committee continues to receive reports of violations of loading rule requirements on open top lumber loading occurring in the southern and southeastern part of the country. Examples of some of this improper loading from these areas are illustrated.

The most serious and disturbing subject before our committee was the trouble encountered with loads of Farm Machinery and Agricultural Implements as per Figs. 171, 172-A, 172-B, and 172-C. In some of these cases the loads fell off the cars when in transit.

Much difficulty is being experienced due to wires breaking at the point of securement to the commodity itself, account of contacting sharp edges of corners, due to vertical oscillation and the omission of protecting plates.

The committee has experienced several cases where farm machinery has fallen off cars due to wire breakage and numerous load shifting, account improper tie down and insufficient securement. Machines fall off cars; wires to the machines contact sharp edges or corners without protection plates; also 4 in. chock blocks.

Tractor Loads Continue to Fail

Due to the continuance of failures of tractor loading as per above mentioned figures and which failures are due to loose twist in hold down wires, causing slack in these wires, the contention is that current loading rules are not adequate for present day longer and faster trains.

We recommend that the ends of wires should be securely tied together and when strands are twisted the twist should be locked to prevent wires loosening, which we definitely feel is to a large extent responsible for breakage of wires and resultant disarrangement of loads.

Fig. 171, Item B—We recommend that alternate blocking per Sketch No. 2 be deleted.

Reason—Committee feels 4 in. block is inadequate, basing contention on trouble encountered.

Wrought iron pipe loading as per Fig. 80 to 84, inclusive, should be carefully inspected at originating point to determine that all loading details required have been complied with. As the length of the pipe and the height of the load above sides of car determine the number of bands or wires and stakes required, inspectors should check these details.

Of equal importance, inspectors at intermediate terminals and interchange points should be alerted to detect any broken bands, wires, stakes, or shifting of the load in transit.

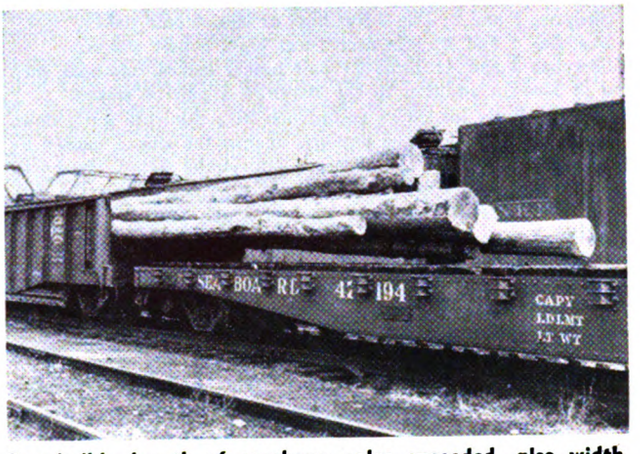
Shippers of pipe should become familiar with General Rule No. 4 to avoid possible concentrated over-loading of fixed end gondola cars with short length small diameter pipe placed in center of the car. This can often be avoided by proper spacing of the outside bearing pieces on floor of car.

The indications are that the shipments of large diameter steel pipe for the so-called "'Big-Inch" pipe lines will increase and continue for many months and efforts should not be relaxed to safely move this large tonnage to its destinations.

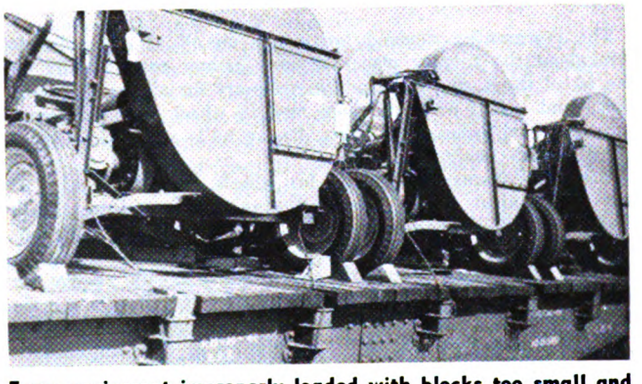
Loading Rule No. 5—Gondola Cars—Observations have been made which show violations of the requirements that load must be secured to prevent "moving or tipping towards sides of car". It is important in this connection that inspectors and shippers be familiar with the 8-in. and 18-in. limits of vacant space across car that requires sidewise blocking of the load.

Figs. 6 & 7, Item D—Recommend an addition to this item to read, "Lumber 1-in. and less in thickness to have 4 separators equally spaced on pile 12-feet to 24-feet long and 5 separators on pile over 24-feet long to 40-feet long."

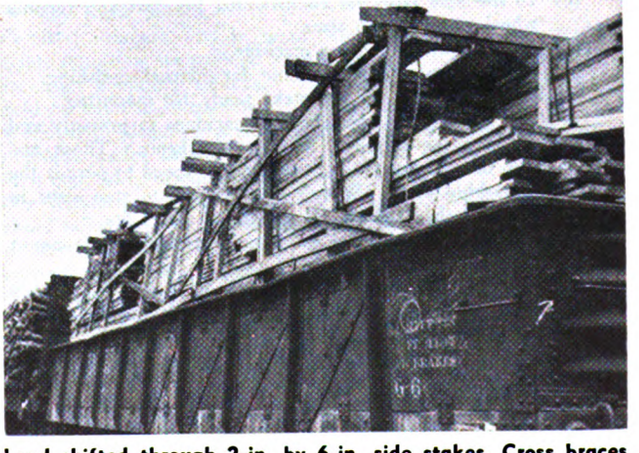
Reason—Separators on 90 per cent of the loads, loaded in accordance with this figure, are two or more inches thick, permitting thin lumber to sag considerably between the separators.



Permissible length of overhang poles exceeded, also width. Bearing piece between body bolster and end sill. Load shifted



Farm equipment improperly loaded with blocks too small and wire hold downs failed causing one of these tractors to become loose and fall off the car



Load shifted through 2-in. by 6-in. side stakes. Cross braces outside of stakes. Stake ties too long. Longitudinal ties wrong and omitted

This allows a bouncing action to set up in road haul, resulting in badly shifted loads. Additional separators would make a more firm load and prevent much shifting of thin lumber.

Fig. 6, Item G—Recommend eliminating (d) under this item.

Reason—Have found that lumber over 24-feet in length, which had been banded by the shippers, shifted less than that which was not banded or wired as permitted by the present rule.

Fig. 27, Item B—Recommend the following revisions in this item:

Sketches 1 and 2: Pile 7-feet high or less, 4 pair stakes.

Sketches 1 and 2: Pile over 7-feet high, 5 pair stakes.

Sketches 3 and 4: Two (2) pair binder stakes, one near each end of load in addition to the required 4 pair of stakes.

Reason—Poles loaded in accordance with this rule settle down out against the stake. The pressure against the stakes, caused by out against the stake. The pressure against the stakes, caused by the spread load, results in broken stakes, which causes the railroads much trouble. Believe an additional pair of stakes on Sketches 1 and 2 and two pairs of binder stakes on Sketches 3 and 4 will correct much of this difficulty.

Proposal—Unpeeled pulp wood—Recommend that a figure or method be incorporated in the Forest Product Pamphlet on the loading for safe movement of unpeeled pulp wood.

Reason—Much unpeeled pulp wood is being hauled in symbol trains and roads, which Members of this Committee represent, are experiencing difficulty with shipments of same.

Shooks or Knocked Down Crates—Recommend that figure be incorporated in Forest Product Pamphlet to cover loading of shooks or knocked down crates; also consideration be given to package loading of this lading, as illustrated in attached photos. (Photos not reproduced—to be referred to A.A.R. Committee on Loading Rules).

Reason—Current rules do not contain figure or specification to govern this type of lading.

Rule No. 10—Proposed by the committee that under heading of Rule No. 10, an understandable method for tying wires be shown; also that a method of tying that will eliminate slack be developed.

Reason—No method outlined as to how ends of wires be tied.

Recommendation—That counting of strands of wire be at the turning point of securement.

Reason—Actual critical point of pull load is at turning point of securement.

Ingot Molds—Recommend that consideration be given to adopt figure and specification to cover the loading of this particular commodity, which is not now covered by rules.

Reason—There being no figure to cover, ingot molds are being loaded in many instances without use of blocking and 18" of crosswise vacant space is excessive. Recommend that maximum crosswise vacant space be 8" without blocking.

(The report was presented by Chairman A. C. Bender, joint supervisor of car inspection of the Cleveland Car Inspection Association).

Wheel Shop Practices

The evergrowing demand for wheels on all of the railroads throughout the country places an ever greater responsibility on the wheel shops, and has made it necessary for all roads to purchase and install new and more modern wheel shop equipment such as wheel lathes, axel lathes, boring mills and various types of Magnaflux equipment.

With this increasing demand for wheels, it is the desire of every mechanical officer and wheel shop foreman to completely revamp his wheel shop by relocating his machines in more advantageous positions, install conveyor delivery devices for moving the wheels and axles through the shops, and in general change the set up so that the work can progress through the shop in a more uniform manner, with a minimum amount of handling, and come out at the finish location ready for shipping or local application. One suggested shop arrangement is as follows:

1. Shop so arranged that either new or second hand axles can be moved on a conveyor from the demounting press in the following sequence:
   (a) Through the sand blast or other type of cleaning.
   (b) Through the recentering machine.
   (c) To the axle lathe for conditioning journals and turning wheel seats to step sizes.
   (d) Through the magnaflux machine.
   (e) Through burnishing machine for journal polishing.
   (f) Thence to axle storage racks ready for mounting.
2. Sufficient number of wheel boring machines to properly and quickly bore the required number of wheels. These machines to be of adequate horsepower and speed to permit the use of carbide tools. Wheels to be bored to step sizes in order to omit the "miking" of individual wheel fits.
3. A demounting wheel press of capacity to quickly dismount both wheels at once.
   (a) Means to quickly dispose of scrap wheels, preferably directly into a scrap car from disposal chute located at the press.
4. A mounting wheel press arranged to press on both wheels without turning wheels end for end.
   (a) An axle rack in connection with the mounting wheel press with suitable jigs so that wheels can be premounted on the axles by hand and quickly rolled into the mounting press.
5. Wheel lathes of sufficient power and speed to quickly and accurately turn mounted steel wheels, using carbide tools if machine is of proper design.
   (a) Means to load wheels into the lathe quickly and safely.
6. Modern mounted wheel journal lathe, end driven, on which rough journals can be turned with carbide tools and journals rolled with opposed burnishing rolls, insuring proper finish of the journals.
   (a) This machine to be equipped with mechanism to quickly and safely replace the wheels into the lathe for turning and subsequent remounting.
7. A modern, end driven journal burnishing lathe for burnishing the journals on dismounted axles, this machine using opposed burnishing rolls. The controls for this machine should be activated by hydraulic pressure to relieve fatigue encountered by the operator.
   (a) Means to quickly and safely load dismounted axles into this machine.
8. A modern Magnaflux machine using "black light" for the inspection of dismounted axles, with suitable connections for the power source so that mounted journals can be magnafluxed with the powder method.
   (a) Means for quickly and safely loading axles into the Magnaflux machine.

Many wheel shops throughout the country are still working with old antiquated machines and equipment that have many years ago served their usefulness and should be retired and replaced with new, modern, high speed, up to date equipment.

It is highly desirable, and in the end more profitable, to retire these obsolete and worn out machines and replace them with equipment that will produce two to three times more and which, over a comparative short period of time, will more than pay for themselves in labor and in production. This fact is proven every day in modern industries. Our builders of automotive equipment are not trying to build 1951 automobiles with 1920 equipment. The builders of diesel locomotives are not trying to build present day diesels with twenty and thirty year old machinery and equipment. Every phase of modern industry is highly streamlined to the point where lost motion and slack do not fit in and with conditions as they are and have existed for the past decade or more, such methods of operation are not only a requirement but also a necessity.

Many railroads are now working to this end in their wheel

shops, and in so doing are finding it possible to centralize wheel and axle work and by doing so are getting a better class of work, greater production and realizing savings in the over all job. One or two strategically located, well equipped and modernly fitted wheel shops will readily displace a dozen wheel shops equipped with old and worn out equipment, from which only a *minimum* of production is being obtained, and in which, in most instances, for many and varied reasons, bad wheel shop practices have crept in. It takes as many men to turn five or six pairs of wheels in eight hours on an old wheel lathe as it does to turn twelve to fourteen pairs of wheels on a modern, high speed lathe, *using* carbide tools. Similar comparison can be made between any old and new machines throughout the wheel shops. Therefore, the ultimate goal which is being sought today by all mechanical departments is to streamline their wheel shops, throw out lost motion and get the full measure of production that we know is possible.

[The report here went into details regarding wear limits for multiple-wear steel wheels, carbide-tip tools, one-wear steel wheels, A.A.R. rules, gauges, etc. The report was presented by Chairman E. E. Packard, district master car repairer, Southern Pacific, Los Angeles, Calif.—EDITOR.]

Discussion

A question was raised regarding the best method of cleaning car axles prior to magnaflux testing and the answer was, "Sand or shot blasting," which, however, cannot normally be done while axles are being progressed through the wheel shop. No suggestion for this particular operation was advanced.

W. D. Nelson, shop superintendent, L. & N., Louisville, Ky., who raised this question, said that he finds only from 4 to 6 per cent of axles Magnafluxed defective and then rarely at the center.

W. N. Messimer, first vice-president of the C. D. O. A. and general superintendent of equipment, Merchants Despatch Transportation Corporation, Chicago, asked how many railroads are equipped to turn one-wear steel wheels and thus get credit for applying wheels to foreign cars. The answer was "not many" and the practice is largely a waste of time.

Car Lubrication

There has been a change in oil and waste specifications since our last meeting and they should be given a fair trial in service. In theory they should produce a better operation and we hope that actual service will so indicate, however, results to date are disappointing.

To give these materials a fair trial we must provide a better job, one of which better workmanship will be of prime importance. There seems to be a persistent trend away from good workmanship and strict compliance of Rule 66, from the preparation of the packing to its final application in the journal box; as well as other conditions which have to do with the prepared packing performing properly.

We have found in great numbers, the following violations of Rule 66 and unless we correct them, very little progress can be expected:

1. Waste does not meet present specifications.
2. Oil does not meet present specifications.
3. Waste is not saturated as per A.A.R. rules.
4. Packing is not transported in proper containers.
5. Oil is not drawn from bottom of vat or container and poured over packing, or packing is not turned as provided.
6. Journal boxes are not properly cleaned before packing is applied.
7. Packing is not applied in one piece if this method is used; rolls are undersize or oversize if this method is used. These cause either under or overpacked boxes.
8. Defective journal bearings and wedges are not removed.
9. Missing and defective journal box lids are not replaced.

There are others but these are the main ones. All are violations of mandatory A.A.R. regulations and rules, and it is up to us as carmen to correct.

Our past requests for a better oil and waste have created some changes and we must insist on a strict compliance of Rule 66, so that full benefit can be derived from them.

Your Committee held a meeting here last April and these were some of the subjects handled—

1. Since greater use of waste retainer, not enough packing is applied.
2. Not enough packing; underpacked boxes seem to predominate.
3. Management still does not allow sufficient time to service-treat boxes in train yards.
4. Rough handling and heavy switching of cars just prior to dispatchment.
5. Oilers and Box Packers are not provided with up-to-date tools or facilities.
6. Train yard supervision not capable of properly educating and supervising oilers.
7. Department foremen, general foremen, general car inspectors and other car department supervision sometimes fail to supervise the second and third shifts of yard employes to the same extent that the first shift of employes is followed up.
8. Too much direct criticism for hot boxes instead of an analytical educational program of prevention.
9. Something ought to be done in providing oilers and box packers, who must work nights, with decent lights so they can perform their work properly.
10. Two of the members proposed a Slow Order for 10 miles of 20 to 25 miles per hour, which would allow the oil to start lubricating before high speeds were obtained, this being more advantageous in real cold weather.
11. Shop system equipment at 9 months for repacking.
12. Wood dust guard plugs, if used, must be held by a retainer, otherwise they are of little value.
13. Handling of spring packing retainer in real cold weather when packing is stiff.
14. When spring packing retainers are used they must be removed every 60 days, at which time the packing must be loosened up and leveled off before reapplication.
15. Better maintenance of journal boxes, failure to maintain lid lugs in proper condition is the cause of losing thousands of lids, plus the failure to protect packing from dirt and moisture.
16. Passenger equipment with roller bearing boxes must have oil levels checked at intervals often enough to eliminate the possible lack of oil.
17. Use wear plates and bushings on lid hinge lugs of all new side truck frames.

Persistent rumors, and in some cases backed by facts, would indicate some few are packing journal boxes with little more effort other than changing stencils. These conditions, when known, should be handled immediately for correction.

We wish to elaborate somewhat on Mr. Nelson's report to Mr. Hawthorne, under date of February 26, 1951. All of you probably have a copy of it or some parts of it.

One hundred thirteen samples from a total of 132 samples of packing failed to meet A.A.R. specifications. 13,500 cars in shops and about 116,800 empty cars in yards having journal boxes overdue for periodic attention were forwarded in service without having this work performed.

How can we expect an improvement in hot box performance, when we persist in allowing such conditions to exist, especially when we have the authority and the duty to correct.

We are supposed to be getting better materials to control hot boxes. We have been griping for years that we were unable to control hot boxes because the materials furnished for this work were inadequate for proper control. If better grade materials are now available, we should be able to do a better job.

Information in connection with magnetic particle testing indi-

MAGNETIC PARTICLE TESTING OF PLAIN BEARING CAR AXLES — 1949

Railroad	Number of axles tested	Number of axles tested crack on journal	Cracked journal OK after turn and test (salv.)	Number of axles scrapped crack on journal
B. & O.	27,101	208	163	45
B. & M.	232	...	...	...
Burlington	43,151	293	164	153
C. & E. I.	4,205	14	no record	14
C. & N. W.	20,756	220	70	150
D. & R. G.	5,111	154	71	83
D. L. & W. (6 mons.)	4,102	27	8	19
Frisco	6,312	635	622	13
I. C.	4,864	306	283	23
L. & N.	10,855	41	0	41
Milwaukee	22,902	80	8	72
Mo. Pac.	9,720	66	0	66
M. K. T. (9 mons.)	999	11	0	11
Nor. Pac.	26,702	255	74	181
New Haven	8,842	14	...	14
N. & W.	3,667	4	0	4
N. Y. C.	23,953	307	record incomplete	
Penna. (mounted)	64,438	737	...	737
Penna. (dismtd.)	37,101	169	...	169
Reading (6 mos.)	3,685	18	...	18
Santa Fe	24,017	272	103	169
SLSW Cottonbelt	11,600	8	...	8
Erie	17,420	209	...	209
Total	381,736	4,048	1,558	2,199
Percentage		1.05	.4	.57

cates the many potential hot boxes and failure had this operation not been performed. It also indicates the many cracks in journals which, no doubt, were the result of previous overheatings.

Much information seems to be packed in these figures: A—about 1 per cent of axles tested show cracks on journals. B—about .6 per cent axles tested were scrapped acct. cracks on journals. C—about half the axles showing cracks were salvaged.

It is understood this is a generalization, as all roads do not test in the same manner, neither are all the reported figures consistent. The wide variation between railroads as to number of cracked journals found indicates the need to carefully re-examine methods of tests and procedure.

Hot boxes are on the increase. Many reasons have been advanced as the cause. All of us have some particular item if changed, improved, added, etc., would solve the problem, but your committee is of the opinion real future progress must come from research of the entire subject.

It is a well known saying that: "When scientific theory differs with practice—the technical man questions the practice, the practical man discounts the theory."

It is possible future research should be provided by an unbiased organization with the qualifications to study lubrication, operation, service, engineering and all related parts.

The A.A.R. has made efforts to improve the oil and still not increase the cost. This is done by "additives" to increase the viscosity index and reduce the "pour point." Additives used to help an otherwise poor lubricating oil to meet a specification probably will not meet the needs. Residual oils blended with distillate oils to reduce the price of oils and throwing in some additives, is not meeting the desire for better lubricants.

Capillarity or oil travel of residual oils in waste is low. The greatest number of hot boxes occur in summer when capillarity or oil travel should be ample to keep the journal cool.

High Film Strength Required

The oil should have a high film strength to meet the needs of fast acceleration and deceleration. The basic quality of film strength has been proven by the A.A.R. Laboratory in their Fifth Progress Report. This report also indicates the value of car oils free of residual, where reclaimed motor oil performed so satisfactorily.

A.A.R. Specification packing allows 50 per cent slasher or sized threads when machined. Cotton warp threads are straight cotton. Slasher is the same thread with a sizing of starch or similar material to the extent of 10 per cent of the weight of thread. Sizing decreases capillarity or oil travel in the threads. Machining is stated as removing this sizing. It does, but only slightly. Why argue about 0.1 per cent impurity in the oil and allow 10 per cent impurity in the waste? Tests show oil travel in new packing containing 50 per cent slasher is good. This is new packing and dry reclaimed oil. What happens when water enters the box? What happens to the sizing in the waste? This creates soggy packing and future trouble. Repacking boxes more frequently gives fresh threads to carry oil, but frequent packing is not the answer to correct other basic faults.

The bronze bearing with a babbitt lining is a plastic material—it deforms under impact. The lack of proper bond of babbitt to the back has caused many failures. Oil seepage between lining and back adds to the dam of heat. A check shows a large percentage of bearings removed from service probably because the bond between the lining and the bearing back could not withstand the service. A bond of greater strength seems desirable.

Copper Penetration of Steel

The great important fact is the effect of the bronze bearing on the axle journal when a hot box develops, the babbitt is sweated out, and the weight of the car brings the bronze bearing on the journal. This is the forerunner of a burned off journal. The copper penetrates the steel. It took a long time to convince some people this was the cause of journals breaking off due to overheating. When the copper penetrates the steel journal, a crack develops about two-thirds the distance from the axle collar to the fillet. This is where the concentration of the bearing gives the greatest heat of friction. Sometimes the journal does not "Burn Off" but develops a crack. A second period of service and this crack is a failure, not readily possible of evaluation as caused by the first hot journal or at the time of failure. Sometimes the crack develops a fatigue fracture after the first hot box; this then is definitely due to the first hot box.

Is it generally understood that 1 per cent of the axles that go through a wheel shop have cracks in the journal due to copper penetration from a previous hot box?

Is it generally known that the figures of the I. C. C. show that the losses due to derailments are mounting from this cause of burned off journals and has now reached the figure of millions?

The cost figures include loss of equipment, damage to right of way, and wrecking expense only, and does not include damage to lading or damages to injured. Reports do not include failures when damage is under $275.

Let us have an unbiased research study made of the subject. Let us make the improvement and changes that are necessary—not influenced by data only half assembled and opinions that are passed as facts.

There can be improvements in all phases of the subjects that are connected with lubrication of cars—any one will not cure the trouble. But if we allow the facts and figures of the poor operation to guide our judgment, we will improve all conditions and have far better operation at a saving of money.

It appears at this time, some A.A.R. specification oil lacks the ability to properly lubricate journals under conditions prevailing during the warm summer months.

(The report was presented by K. H. Carpenter, chairman, superintendent car department, D. L. & W.)

Discussion

J. J. Laudig, research engineer, D. L. & W., Scranton, Pa., said the finish on the inside collar of the axles should be the same on the fillet. He liked the idea of better car oils and said that proper additive in clean oil "does the trick."

A member from the Pennsylvania said that with spring retainers in general use journal box packing should be packed to the center line instead of one inch below to assure its not dropping away from the journal and causing a lubrication failure. He said these retainers should be removed for inspection every 60 days and train speeds limited to 15 m.p.h. for a short time before getting to maximum speed.

W. J. O'Brien, general car foreman, N. Y. C. & St. L., Chicago.

LOSSES DUE TO JOURNALS BROKEN, OVERHEATING

Year	Bul. No.	Total number accidents	Derailments	Injured	Total reported damage
1947	116	509	421	2	$1,618,059.00
1948	117	481	411	8	1,754,593.00
1949	118	420	371	19	2,292,062.00
1950	119	571	491	30	2,701,809.00

suggested a joint committee with operating men to get some action on rough handling.

F. K. Mitchell, manager of equipment, N. Y. C., New York, said that in the absence of other changes except in oil, he believes the recent change in A.A.R. oil specifications is a mistake and the N. Y. C. is now using another type of oil with additive. He referred to a joint committee already set up with the Transportation Division and said that the change from plain to roller bearings is on the way but cannot and should not be too quick. In the meantime better results must be secured with present details.

F. T. James, superintendent motive power and car equipment, D. L. & W., Scranton, said that three alibis are usually offered for all hot boxes: box damaged; waste grab; or poor workmanship. He also doubted if the new oil specimens are entirely satisfactory and called attention to the influence of heavy load on hot boxes which seldom occur on empty cars.

John Carver, mechanical and research engineer, I. C., Chicago, referred to themo checking in train yards; distorted journal bearings, due to humping cars; better and stronger bearings; and oil with more "guts" for heavier loads and speeds.

Refinishing Passenger Equipment

It was decided this year to show, in some technical detail, the cooperation between the paint department and the engineer of tests. From the practical side, tests are often made by the paint foreman doing a job to be tested in actual service. In this manner he can tell how the material handles both by brush and spray application, and also determine hiding qualities, flow-out, coverage and general performance, which is so essential to proper finishing. Then following through the various phases over a period of time he can check as to durability, etc.

This practical test is of great value but suppose the material does not work out satisfactorily? In that case time and money are lost by both the railroad and the manufacturer. This would require a new batch of material and another test. So, when a new product is desired or some manufacturer is allowed a chance for approval on an item, generally, the engineer of tests first receives a small sample to examine the contents by laboratory tests and to determine, as well as is possible, that the product is just about what is required and approves or disapproves it from a technical standpoint.

In line with this procedure we have invited a laboratory or technical man to join us and explain just what methods are used to determine the suitability of the various products.

Testing of Passenger Car Cleaning and Painting Materials

Railroads generally purchase paint and cleaning compounds to a specification where practical. From the purchasing agent's standpoint, this is ideal as it enables him to obtain competitive prices. From the technical standpoint, however, a specification does not permit a manufacturer to utilize the latest developments in his field which in a number of cases would result in a better and, probably, cheaper product. Consequently a progressive railroad will purchase proprietary as well as specification items.

It is the concern of the engineer of tests to see that the products furnished meet the requirements and are suitable for the purpose for which they are intended. When a sample of paint is received in the laboratory, the first step is to evaluate the material by various methods. This gives information whether the requirements have been met, or if the item has not been purchased to certain requirements, if the combinations are consistent with good practice.

Determination of Drying Time

One of the tests made is the determination of drying time. If the paint does not set up and dry within a reasonable time, dust will settle on the surface creating an unsightly appearance and may necessitate the job being re-done. Trouble would also be experienced if masking tape were used over poorly dried films. The finger touch method is generally used to determine drying properties. A paint film is considered set to the touch when it is lightly touched with the finger and none of the coating adheres to the finger. It has dried hard when pressure can be exerted between the thumb and finger without movement of the film. Close adherence to the specified drying times is necessary as they have been established to conform with shop schedules to permit uninterrupted flow of material on the production line.

Some of the complaints the laboratory receives is that the paint is too thin or has livered. Such complaints are justified because the body or viscosity is directly connected with the proper application of the paint to produce a film of satisfactory appearance as well as good protection. Various chemical reactions sometimes occur between the vehicle and the pigment in a paint resulting in a false body or even livering. Such paint is generally useless because if it is excessively thinned, the chemical balance of the constituents are disturbed. The most economical practice would be to return such paint to the manufacturer for replacement. The instruments for checking viscosity are usually of two types: the simplified efflux type which measures the body of the paint by the number of seconds required to flow through a standard orifice and the torsion type which measures the consistency of a paint by the speed of a rotating member immersed in it.

Lack of Covering Capacity

A paint lacking the power to obscure the surface to which it is applied, fails to serve its purpose to protect and preserve. This quality of a paint is known as the relative hiding power. This test is usually performed in accordance with the American Society of Testing Materials Method D 344-39 and consists primarily of checking the relative hiding power of a definite weight of paint over a prepared test surface and compared with the prepared samples of standard paint.

One of the most important things one must consider from the standpoint of public opinion is good appearance of passenger equipment. This involves control of color and gloss. Color matching has always been a difficult matter whether based on wet samples or spray-outs due to changes in shade resulting from various chemical reactions. A method developed by a western printing company is now being used by a number of railroads with considerable success. It is based on the use of color charts prepared by a special process which are said to retain the original shade for periods to twenty years. They can be obtained to match most types of finishes.

A high gloss on the exterior of a passenger car tends to create a favorable impression in much the same manner as on an automobile. The extent of this gloss can be measured by the use of a gloss meter. Such an instrument assigns a definite value to the reflective properties of the paint film ranging from a flat finish to a high gloss. With such control the paint manufacturer can furnish any gloss desired by the consumer with reasonable accuracy.

Effect of High Train Speeds

The high speeds of the streamliners today subject the exterior of the passenger cars to considerable impact damage from flying gravel and sand. The extent of abuse a paint film can withstand is determined by impact tests. One of the simplest methods is the dropping of various shaped tools on the paint film. For example, small pieces of steel rod ⅜ in. by 2½ in. are shaped at one end to either a round, chisel, flat or triangular nose to simulate different kinds of road ballast. These are dropped through 24 in. x ½ in. tube striking the panel placed under the tube. The results are evaluated on the basis of chipping or indentation of the paint film. This test is generally combined with the toughness test as they are more or less related. Toughness is determined by coating tin panels with the enamel or paint, drying over night and then baking for a specified time. When cool, the panels are bent 180 deg. F. over a ⅛ in. rod. Brittleness or lack of toughness is indicated by the development of cracks at the bend.

Abrasion is not only caused by flying sand, but also car washers now being used by the various railroads. Therefore, the abrasion resistant properties as well as the effect of cold and hot water, and chemicals on the finish are factors that must be considered. One type of instrument used to determine how much wear a paint film will withstand, and specified in some specifications including those of the Federal Government, consists in determining the loss in weight of the coating being abraded by standard rubber wheels for a designated number of cycles. Obviously it is only a comparative test and will not indicate wear under actual conditions. It is useful, however, in rating competitive products.

The cold and hot water resistance is determined by immersing coated tin panels in boiling water for 15 min. and cold water for 18 hrs. Only top quality products will stand this test without changes in color, gloss, and other film properties.

Cleaners Can Be Damaging

Since various acid, alkali, and hydrocarbon emulsion mixtures are used in car washers and other washing systems, tests must be made to determine the extent the paint film will be affected by these products. The films are prepared by dipping large test tubes in the paint or enamel being tested and allowing to dry in an inverted position. This process avoids edge effects which would result from the use of flat panels. These coated tubes are then immersed in 10 per cent hydrochloric acid, 10 per cent sulphuric acid, 10 per cent sodium carbonate, 5 per cent sodium hydroxide, saturated oxalic acid, and mineral spirits for varying periods of 2 to 8 hrs. The films are rated on the basis of softening, loosening from the support, discoloration and blistering. These are accelerated tests and some of them are quite severe. Failure to pass any particular one does not necessarily condemn a product. It gives some idea of what can be expected under normal or abnormal conditions and serves as a means of classifying competitive brands.

In the final analysis, the best criterion for judging quality of paint or enamel is the exposure test. Outdoor exposure tests have been conducted for many years by paint manufacturers and others. However, it is time consuming and usually results are desired in a much quicker manner. This is accomplished by the weatherameter which exposes the paint to artificial sunlight in addition to heat and moisture. Various cycles can be established to duplicate different kinds of weathering conditions. Results obtained by this method must be interpreted with caution as it does not include the effect of corrosive gases, extreme cold, acid conditions, high humidity, salt water or the abrasive effect of wind-driven grit and dust. It does afford a good method for comparing products with established standards. It also gives indications of the amount of fading, chalking, loss of luster and the erosion or washing of the film one might expect in actual service. The nature of film failure such as checking, flaking and scaling is important advance information from the point of view of having a suitable surface for repainting without expensive cleaning.

Complex Modern Detergents

We now come to the question of cleaning compounds for passenger equipment. The dirt that must be removed may consist of fatty oils, grease, oily deposits, tarry residues, metallic compounds mostly iron, siliceous matter and alkali dust. The average conception of a cleaning compound is that it consists of soap or washing soda. But the modern detergent is much more complex. It may include soap, sodium carbonate, sodium bicarbonate, sodium hydroxide, sodium sesquicarbonate, monosodium phospate, disodium phosphate, tri-sodium phosphate, sodium hexametaphosphate, sodium pyrophosphate, sodium acid sulphate, borax, oxalic acid, hydrochloric acid, sodium silicate, wetting agents and synthetic soaps. The combinations used depends on whether the cleaner is to be used for light or heavy duty. Hard water solutions require certain types of phosphates to solubilize calcium and magnesium compounds to prevent their precipitation on the surface in the form of a hazy film. Wetting agents increase the penetrating properties. The synthetic soaps can be used in either acid or alkaline solutions. It is the duty of the chemist to determine by chemical analysis if the combinations used are satisfactory for car cleaning. Excess alkalinity would reduce the gloss and soften or even remove the finish coat. Excess acidity would create corrosion problems and affect the color by its bleaching action. Chemical analysis also detects cleaners that have been over-loaded with inert compounds that have no detergent value. Some liquid types have been found to contain as much as 98 per cent water for which a high price was asked. When the laboratory tests have shown that the formulation is a sound one and that it will not damage the paint film, a terminal test is conducted under the supervision of the Test Department for the final rating as to its efficiency in cleaning cars.

In this discussion, I have tried to show how the work of the test department fits in with the painting and cleaning operations of the railroad. Co-operation between the shop forces and technical groups is essential if each is to profit by the others knowledge and experience. The test department is the connecting link between the manufacturer of cleaning and painting materials and the railroad. It not only serves to maintain quality but is also concerned with proper application. Although not a part of paint testing, the preparation of the surface before priming or other painting plays quite a necessary part, because if the surface is not free of grease, rust, water or other defects, the careful examination of the paint in itself is wasted effort.

The report was submitted by a committee of which E. M. Driscoll, foreman painter, C. M. St. P. & P. was chairman.

Discussion of Report on Painting

N. E. Carlson, assistant master car builder, G. N., St. Paul, Minn., said that manufacturers are in many instances being unfairly blamed for poor results with their materials which may be the best available for the price paid. He indicted that paint failures often occur because of improper application or subsequent care. For example, excessive use of putty in building up surfaces may cause trouble, and paints lose luster with careless cleaning. Mr. Carlson said that all cleaners with enough guts are good, but must be used carefully. Illustrative of what should not be done, Mr. Carlson said that after two years service on the Empire Builder two out of 12 cars showed a lack of luster which it developed was due to the cleaner being applied by hand at one terminal late in the forenoon and allowed to stand while the men went to lunch.

W. J. O'Brien, general car foreman, Nickel Plate, Chicago, referred to paint failures which cause rapid deterioration of folded step designs and asked what could be done about it. One suggestion advanced was the more extensive use of stainless steel in this construction.

C. W. Kimball, supervisor of car inspection, Southern, asked if there is any preference as regards the use of acid or alkali-type cleaners on steel passenger equipment. One reply was to use the acid cleaner first and then alkali to neutralize the acid in crevices. The concensus was that whichever type is used, cars must be thoroughly rinsed afterward.

A representative from the D. & R. G. W. said that equipment appearance sells service and the painter foreman must sell himself to his superior officer. He said that on his road passenger cars follow the sun all day formerly faded on one side, but this problem has now been solved by use of proper paint materials and careful cleaning. He raised the question about how painters can avoid being thrown out of diesel locomotives and said they must insist on having enough time to do a good painting job on diesel locomotive interiors. He stated that the excessive use of putty in smoothing or building up diesel front ends under the finish materials is causing trouble.

A paint chemist from the Santa Fe called attention to the difficulty in using two types of cleaners in mechanical washers unless especially designed for this purpose. He said the contemplated use of an alkali cleaner in the car washing machine and acid type the next day would be impractical because irregularity in individual car assignment might result in some cars getting one treatment exclusively.

L. A. Hartz, painter foreman, I. C., said the use of alkali cleaners avoids the necessity of trying to wash acid out of crevices in the car exterior surfaces.

President Deppe said the vinol-resin-type painting material seems to be resistant to both alkali and acid cleaners, but some penalty has to be paid in loss of gloss an added cost.

A. W. Leitner, assistant superintendent car department, S.A.L., Norfolk, Va., suggested an A.A.R. study to recommend materials and methods for satisfactorily cleaning passenger car equipment.

L.M.O.A. Breaks Attendance Records

With a program of four addresses and nine technical reports on diesel and personnel subjects meetings attract large groups

FOR the first time since the Locomotive Maintenance Officers' Association was formed in 1939 the registration at the September meetings this year passed the 900 mark and the total membership of the association, at the close of the convention had reached a record high—3,515.

F. K. Mitchell, manager, equipment, New York Central System, addressed the association on the vital necessity of making adequate plans for future mechanical servicing and maintenance facilities. His address was abstracted in the October issue, appearing on page 63. In addition remarks were made by W. T. Faricy, president, A. A. R., and J. H. Aydelott, vice-president operations and maintenance department, A. A. R., following the presentation of life memberships in the association and an address was made by E. H. Davidson, director, Bureau of Locomotive Inspection, Interstate Commerce Commission. Nine technical reports were included in the program, as follows: Winterization of Diesel-electric locomotives; report on water and oil leaks, air filters and extension of inspection periods; report on diesel truck maintenance, welding and the servicing of steam power; shop tools; diesel material reconditioning; diesel terminal facilities and a report on the cleaning and testing of traction motors and other electrical equipment.



P. H. Verd, President
(Superintendent motive power and equipment, E. J. & E.)



H. H. Magill, First Vice-Pres.
(Superintendent locomotive and car shops, C. & N. W.)

C. M. Lipscomb, Sec.-Treas.
(Assistant to schedule supervisor, M. P.)



Safety and Locomotive Operation

Mr. Davidson discussed safety in relatio to diesel-electric locomotive operation and said, in part:

"During the past ten years there has been an accelerated trend toward the use of diesel-electric locomotives until today over one third of all locomotives for which reports are filed with the Bureau of Locomotive Inspection are propelled by power other than steam.

"The ratio of accidents to the number of defective steam locomotives found by our inspectors has shown a considerable increase in the years following World War II as compared with the corresponding years before outbreak of hostilities. This situation may be due in part to increased age of the steam locomotives combined with the beating they took during strenuous days of war transportation but I suspect there may be other considerations involved. In our interest in the glamour girl of the rails, the diesel, let's not forget the steam locomotives of our rail system and see that they are properly maintained.

"When steam locomotive repairs are called for on engineer's or inspector's reports these repairs should, in the interest of safety and economy, be made in a thorough and substantial manner. If this procedure is followed there will be fewer defective locomotives found by our inspectors and there should be correspondingly fewer accidents caused by defective parts or appurtenances of locomotives. I suggest that a procedure whereby work reports could be reviewed in order to determine whether identical items are reported time after time would be helpful. If the same item on a locomotive is continually reported by several engineers it would appear that repairs may have been inadequate or some condition exists that requires mechanical or technical consideration.

"The safety movement on railroads is perhaps the grandfather of all industry wide safety movements. The railroads have supported this movement enthusiastically both financially and by delegation of personnel to study the problem, determine causes of and remedies for accidents and to carry the gospel of safety to all employees. The cost of accidents in terms of financial loss and human suffering is now a matter of national consideration. We cannot waste our human, industrial or transportation re-

sources any more than we can permit waste in our agriculture, forests or mineral reserves.

"Industry is today doing something in a big way about industrial accidents. Can we in the mechanical branch of railroad transportation do less? I think not. Railroads have had safety organizations for decades. They have safety committees, supervisors and members of the various crafts who have had the benefits of educational programs. We have the know how; all that is required is perseverance.

"Failures that have occurred in wheels under diesel locomotives are cause for concern. Two serious derailments have been caused by wheel failures and in addition we have record of a number of wheels in which extensive and dangerous cracks have developed under service conditions but fortunately did not result in casualties. Perhaps the most spectacular failure was one where a circumferential crack developed in the plate at base of rim fillet, extended completely around the wheel and resulted in complete separation of the rim from the plate. The subject of wheel failures is being intensively studied but procedure to eliminate cracks has not as yet been finally determined. The gravity of the situation requires that wheels be given frequent and meticulous inspections while in service in order that defective wheels may be discovered and removed before failure occurs. Because of exterior inaccessibility the units should be placed over a pit and moved as necessary to permit examination of all parts of both sides of each wheel. Cracks are usually fine and difficult to find unless suraces are cleared of scale, dirt and compound deposits which cover or obscure surface cracks associated with progressive or fatigue failures. One railroad which had an unfortunate experience with a failed wheel is going to the extent of whitening wheels at time of pit inspection. The careful inspection of diesel wheels at intermediate points when locomotives are used in long runs is strongly recommended.

"Other safety measures on diesel locomotives which merit attention are application of safety hangers to unsupported brake rigging which will prevent the rigging from falling to the rail in event of a hanger pin failure, application of long fuel tank gages and means to prevent loss of oil in event of a broken oil gage or fitting on fuel oil tanks; removal of accumulations of oil soaked litter and debris from tops of oil tanks and other locations where a spark could cause a stubborn fire; elimination of leaks which deposit oil on passageway floors and other walking surfaces and which have been the cause of a considerable number of injuries from falls.

"A number of defects have been reported in connection with jumpers and connectors between units. Use of jumpers of improper length which hang low enough in passageways to strike the face of a man hurrying from one unit to another create an unnecessary personal hazard. The deterioration of protective rubber coverings and fraying of insulation increases the danger of fire and short circuits. Use of jumpers having protective covering made from rubber synthetics which are more oil and abrasive resistant than natural rubber might merit consideration.

"These matters which individually do not appear large are best described by the term poor housekeeping. If units are adequately policed and inspected the danger of accident will be correspondingly reduced and economy should be effected by reduction of heavy repair expense caused by neglected repairs."

Training Diesel Personnel

Interest in any subject is a prime factor, for without it we cannot expect the information being taught to be effecive.

The personnel to be trained must be interested. The means employed to accomplish this then is of first importance. There cannot be any acquisition of knowledge without proper interest in the subject. A stimulus to arouse interest must be used where individuals do not manifest interest.

All previous committees labored with the problem of interest. I cannot think of any greater need whether directly, or indirectly, connected with diesel locomotives, than an attitude conclusive to a desire to acquire all the knowledge relating to any particular phase of diesel operation. All mechanics whose basic trade relates to this type of power will find themselves easily adjusted to the transition if they will but manifest a responsive attitude, or interest in the essential training.

The interest in this subject is incumbent on both management and labor, since each, when analyzed, will be found dependent on certain factors relating chiefly to the subject of interest. Management and Labor, since each, when analyzed, will be found dependent on certain factors relating chiefly to the subject of interest. Management must realize the need of trained personnel. The value of the equipment is so great that the loss of available working hours is much more critical than is the case for equipment which is not so expensive. Management realizes that an investment, to bring proper returns, must have the highest availability. To have high availability, they must have trained personnel.

Labor must recognize its responsibility and cooperate with management in the development of trained personnel. This type of power should challenge the initiative of Labor since its scope has promise of security. There must be a mutual understanding between Management and Labor through which the progression of methods of training can best be advanced. Labor should likewise see the importance of their contribution to the welfare of the industry, and in so doing, their welfare and livlihood.

Each should see their common interests are at stake—management through proper returns on investment and in better care and maintenance of equipment. Labor should be able to see the perpetuation of their skill through training, affording opportunity for youth, and security for the aged. From the workman's point of view, his very soul should pulsate with a burning desire to know. If the committee can set forth in this report the proper perspective of the possibilities that can be realized in the field of education through interest in personnel training, then the other phases of the actual methods of training will be easy.

First, we must arouse an interest in the young man who wants to learn, the mechanic who already has a basic knowledge of the fundamentals relating to the trades employed in diesel repairs, and the helper who did not have an opportunity to serve an apprenticeship. To the mechanic who will apply himself, there is opportunity ahead. All members of this Association should study ways and means to cause a desire in all their employees who might be needed in diesel work to interest themselves in making the most of the opportunity that can be offered by their respective railroad. Likewise, labor, as a whole, should work with management to the end that skill of workmen will be commensurate with the growing need brought about by the expansion of diesel power.

When considering the classification of personnel that should be trained, everyone employed in Diesel work, whether servicing, maintaining, or supervising should be trained in accordance with their responsibilities.

The classification usually found on Class I railroads might be summed up as follows:

1. Apprentices—through standard 4 year apprentice courses; 2. Upgraded employees; 3. Mechanics—already qualified on other types of power, such as steam locomotive men; 4. Supervisors. This generally represents the class, or type of personnel coming under the scope of this paper.

The necessity to create interest in the apprentice should be briefly explained that his apprenticeship has within it the potential possibility of training him to be skilled in diesel work and the rewards are directly dependent upon his attitude and ability to follow the courses outlined by his company under the four year apprentice system.

Upgraded employees, somewhat like the apprentices, should be sold upon the merits of being trained, and their interest directed to the possibilities afforded through training.

The mechanics that have been previously trained in other types of power should be encouraged to apply themselves in this new type of work, and their interest should be cultivated in such a manner as to impress upon them the importance that to be skilled in the maintenance of steam power, or other power, required a skill that they had to acquire, but it is not enough to rest upon the laurels of the trade previously learned unless they are checked for their relation to this new type of work, therefore, interest can be created by the proper approach, comparing methods previously employed by the methods that will be required, and if by skillful comparison an illustration is made, the need of interest then is apparent.

The training of supervisors for supervisory work has been treated upon previously before this association, but the need for, and necessity of interest on the part of supervisors possibly is the greatest factor in the element of interest, because it is through the supervisors that the need for both management and labor can be made known to the working personnel. A supervisor is the go-between, the mouth piece of management to set forth the need for interest on the part of all that he supervises, and he himself must be conscious of this need before he can disseminate correct information, and correct instructions. No man is skilled as an instructor unless first sold on the subject he is teaching. Interest then is propigated by discussion of interest elements or factors relating to the demand. Labor under the various types of classification then should recognize their responsibility in aligning themselves with the problems of interest in order that this subject can be effectively pursued.

How to Create Interests

Here we find a close relationship to the need, or necessity of interest, since it can be readily understood that to create interest there must first be a need. The factors of mental thought in which interest has been aroused must be centered on the subject into what might be termed the ability to concentrate in such a manner that knowledge will be acquired through training procedures. It follows then that there must be produced the proper stimulus, or interest elements, to produce or create interest. Then the results of efforts put forth through methods employed will produce the desired results. The approach to this problem, "How to create interest," will be in direct ratio to management's ability, through instructors using elements of interest, to produce a trained employee, since if an employee undergoing training fails or lacks in interest, there will be no infusion of knowledge of the subject taught, as information relating to the diesel locomotives must fall into proper sequence, beginning with basic fundamentals and gradually enlarging until all subject matter has been taught to cover details necessary to a well-rounded knowledge of the diesel locomotive.

Instructors, whether they be supervisors in shops, or in class rooms, must recognize the effectiveness of information they are treating upon. The intended purpose is to implant in the minds of those being taught, and being trained, the ability to retain such information, which must be forcibly and effectively paneled. The effectiveness of teaching or training is tantamount to he ability of the instructor to inspire the one being trained, *since without interest there can be no expected results.* Then it follows that there *first must be a need* (which has already been set forth): *second, a desire; third, desire will, when* inspired, find a way to its realization. From these fundamental principles we have the success or failure of the effectiveness of training.

The ability to create must also have within it inspiration. In this we have then, the fundamental elements of how interest is created. We find these principles employed in salesmanship, and without these elements we fail to sell. Therefore, instructions given by instructors must be characterized with elements of interest, setting forth the need for such training.

The question of how to create interest can best be understood when we approach the subject from the proper perspective. The subject, or person to be trained, first of all, must have within his own mind a well fixed motive, motivated by his own desire that will incite him into action, and as a result we will have an infusion of knowledge into the personnel being taught.

We must understand that to create interest, the subject being taught is not necessarily new to the instructor, but he is endeavoring to teach the subject under consideration in such a manner that it will fasten itself upon the person being taught. The acquisition of knowledge as we review the success of any endeavor, is by a gradual process, or a desire in action. To illustrate; interested personnel is like unto an undeveloped resource, all of the potential possibilities are there. The exploitation is a challenge to management to fully utilize training methods in their possession, or upon their railroad to the fullest advantage. It is through these means that interest can be created because there is within the possession of every railroad sufficient personnel and materials to adequately instruct their personnel, if personnel manifests a responsive attitude, then trained personnel will be the result.

The greatest success in how to create interest is to never approach the subject of training from the standpoint of it being too difficult, but that by proper attention and attitude of the person being trained, when assured by those teaching, that this subject has clarity, and can be easily understood when given the necessary attention.

Briefly, training methods might be summarized as: 1. Handling every subject individually; 2. Don't give a man more than he can understand in any one session; 3. Break the subject down into small steps.

With these assurances, training procedures can be gone into with the personnel to be trained with a premise well fixed, and that is, that they will not stagger under the magnitude of the scope of the diesel locomotive.

Every person must be convinced that the diesel locomotive is not something which is impossible to understand, but that the application of good common sense with a little additional knowledge will enable anyone to do the required work. Every phase taught should be characterized in such manner as to create confidence in the personnel being taught. Allow personnel the right of individual initiative wherever possible to stimulate his reasoning. By so doing, his training will then have the quality so necessary after it has been considered finished, which has had in it the element of self initiative, and by this initiative will be able to apply himself properly.

The creation of interest will depend largely upon the conditions found in the various company shops and enginehouses, and training can be suited to such conditions. A review of what the training consists will be of great importance, since the one being instructed should have a perspective, or a goal to reach. This means self evaluation, or knowledge of subjects, or break down of work would be the natural thing to expect of the person being taught in which he would ask himself how much he knows about this or that, etc.

The diesel locomotive must be pictured to the maintenance forces as power that requires the proper respect, and we place first in the category of training of the untrained man that this type of power demands cleanliness. We cannot place too great an emphasis on the subject of cleanliness, for in this we must first impress the trainee that we are dealing with an art that demands respect for cleanliness. The intracacies of this machine, whether related to the internal combustion engine or to the electrical control or power circuits will be best maintained when personnel being trained have instilled into their basic training that cleanliness is a demand in which the art of the how to perform diesel work demands the utmost respect and the instructor should ever keep before the trainee, and teach him to watch out for the extrinsic and intrinsic forces that are brought to bear in this work that are shrouded in the elements of uncleanliness. Continued, or sustained, interest into all the ramifications of this subject should carry with it color and emphasis that the art, or skill be characterized with pride, and that pride can only be exemplified when presented

clean. *Let this ring throughout the classroom, the instruction car, in the shops, in the enginehouses, and on the diesel tracks until it will become a by-word to the personnel.*

While this paper is addressed primarily to mechanical and operating personnel which might be expected to perform maintenance work, management through its supervisory personnel should teach all personnel that cleanliness is a demand on every person who comes in contact with the diesel locomotive; to the operating personnel, pride in the handling of materials, and the use of this locomotive should be characterized with cleanliness, and solicit that they give this the consideration due. Likewise the forces engaged in the cleaning of the locomotive, whether they be laborers, or helpers, should be taught how to respect and how to perform a good job of cleaning. There has been damage done to diesel locomotives simply because the working personnel has not been trained in the art of cleanliness, and this should be emphasized. This section of the paper is devoted to other than the maintenance forces which will include, as stated above, the laborer, helper, and the operating man, not necesarily engaged in repairs, but simply that the lessons of how to keep clean themselves and how to keep the locomotive clean a consideration of first importance.

No attempt will be made to advise railroads in their methods of grading, since it will be noted that the purpose of this paper is to create interest and how to train diesel personnel. Every road, when setting up its methods of training should be able to evaluate its personnel by grades, or classification, peculiar to its operation. Most Class I railroads issue apprentice certificates at the completion of their apprenticeships. Upgraded employees can be certified by the proper mechanical officer who can verify with respect to their knowledge of the work in which they are engaged. Mechanics already trained can be certified when they have acquired the technical knowledge necessary to diesel work. Supervisors who are promoted, after they have been trained in diesel work might be graded strictly on their supervisory ability, by the proper mechanical officer. It would be normally expected that they would have a basic knowledge before being placed in charge of diesel maintenance or repairs.

This report was a presentation of a committee of which E. V. Myers, superintendent motive power, St. Louis-Southwestern was chairman.

Centralized Reconditioning Facilities

With the rapid dieselization of the railroads, modern diesel back shops have become a prime necessity. Many diesel locomotives are no longer new, and the accumulation of mileage and age has created an increasing demand for modern heavy repair shops.

The economies realized from the modern centralized reconditioning facilities are (1) Higher locomotive availability; (2) Lower "between-shop" maintenance costs; (3) More efficient locomotive operation.

Of the three, the higher locomotive availability is by far the most important. Availability was the main selling point for the diesel locomotive and unless modern back shop practices are followed, the primary purpose for which the locomotive was purchased will be defeated. It has been stated that if a 10 per cent improvement in the efficiency of the locomotive were to result in a 10 per cent reduction in fuel cost, the percentage reduction in total cost of operating one train-mile would be only 2 per cent. When availability in a fleet of locomotives is considered, substantial savings may be obtained by a small percentage increase in the number of locomotives available for service.

In the selection of a site for the shop, future, as well as present day, power assignments must be given consideration. As additional locomotives are placed in service, a central location today may prove otherwise in the future. The source of repair parts and raw materials should be studied, and the shop should be located so as not to impose excessive freight charges on these supplies.

The money available for the construction of shops is a governing factor when determining if an entirely new shop shall be built, or if some existing shop is to be converted. On some railroads it has been necessary to retain part of the shop for steam locomotive repairs. Many shops lend themselves readily to this plan.

When converting a steam shop for diesel repair work, several problems must be considered, among them being the delays allowed in the existing steam locomotive repair schedule, and the ability of other shops on the system to absorb the classified repairs that are necessary to keep the remaining steam locomotives in proper condition. A considerable amount of foresight and planning must be used if serious delays in steam locomotive schedules are to be avoided.

The basic equipment and machinery required in a diesel heavy repair shop will depend entirely upon the number of locomotives to be maintained and the extent of the overhaul that the railroad wishes to make. In some cases the manufacturer's "repair and return" and "unit exchange" may prove economical and a complete cost study should be made on the repair operations before the basic machinery is purchased.

An example of actual back shop layout is the Baltimore and Ohio's new diesel shop at Glenwood, Pa. This was a steam back shop converted entirely to diesel work. The shop is 638 ft. long and 232 ft. wide, and contains three bays. The side bays are serviced by a 30 and 15 ton overhead crane. In the center bay are two 100-ton overhead cranes with 15-ton auxiliaries. The center bay contains 3 tracks with depressed floors, and 100 ft. platforms on the inbound and outbound tracks. The third track is equipped with a 60 and 90-ton drop table for damage and heavy running repair work that is too extensive for the ordinary enginehouse. One of the side bays contains facilities for engine cleaning, painting and overhaul, injector, fuel pump and power assembly work. In the other side bay is located the electrical shop, machine shop, pipe and tin shop and storehouse. On the overhead balcony the air pump repair work and air brake test racks are located as well as a class room for diesel locomotive instructions.

To illustrate the functioning of this shop, we will follow a unit through its course of heavy repairs.

First the unit is drained of fuel, lube oil and water, just outside the door on the incoming track. As the unit enters the shop adjacent to the platforms, the hatches are removed and the engine is lifted from the car body and placed on a dolly. The engine is moved to a totally enclosed wash rack, where it is cleaned externally. Moving along the dolly track, the engine is taken to the disassembly spot, where it is completly stripped. The engine parts are cleaned thoroughly in several modern cleaning machines, while the crankcase is immersed in a special 8-ft. by 16-ft. cleaning vat.

The engine parts, accessories, and crankcase are moved on an assembly line basis down the side bay to the non-destructive testing, inspection and engine parts repairing section. Located at this point are the various jigs, benches, honing machines, valve grinders, etc., that are used for repairing and reconditioning the engine parts. After leaving the repair section the crankcase is painted in a spray booth and placed upon a dolly, ready for reassembly. The work is all done on an assembly line basis as much as possible, using roller type conveyors for the handling of engine parts. Unnecessary movements are kept to a minimum, in fact the cleaning machines, paint spray booth, work benches, tool room, etc., are all located within 20 ft. of the center line of the engine dolly track.

In the meantime, the car body has been lifted from its trucks with the 100-ton overhead cranes, and placed on trestles for body and cab work, and rewiring where necessary. The trucks are moved to the truck repair section which is located at the far end of the center bay. Here the trucks are inverted and dismantled, and handled on an assembly line basis. The wheels and axles go to the machine shop for turning and burnishing, while the traction motors are taken to the electrical shop located in the adjacent bay.

At the present time basic motor and generator overhaul only is being done in the electrical shop; this includes bearing renewal, commutator reconditioning, motor cleaning and baking, traction motor frame repairing, battery, contactor and miscellaneous electrical parts cleaning and repairing. No traction motor or generator rewinding work is being done at the present, but future demands may warrant facilities for these heavier repairs, and space has been allocated for this work.

The reassembly of the locomotive begins with the placing of the car body on the reconditioned trucks. The engine, generator and accessories are reapplied after the locomotive has been moved to the platform section on the outgoing track. From here the locomotive goes to the roundhouse, where several stalls have been converted to a paint shop. The external painting is done in this shop.

The locomotive is now ready for load testing. The performance of the engine can be closely observed under load test, and particular attention should be paid to the water, oil and bearing temperatures. Any defective material or improper tolerances should be discovered at this time. The money spent as a result of a crankshaft failure may well pay for the installation of a complete engine load tester.

For any efficient shop operation, the scheduling of locomotives and flow of materials are vital points. As an example of good scheduling, one railroad is able to give a unit a complete 30-month (350,000 miles) overhaul in four 8-hour working days—completely load tested and back in service. They are able to do this by having two spare trucks, one complete engine, four spare cooling fan motors, four blower fan motors, and spare fuel pump and cab heater motors. They use advanced scheduling so that all material is reconditioned and ready when the locomotive arrives in the shop.

Diesel Truck Repairs

Two systems are generally employed for maintaining and repairing trucks of diesel units. With one system a railroad will remove trucks as a unit after a predetermined span of time depending upon mileage or months of service, replacing such trucks with new ones or trucks that have been overhauled. With this system if a defective motor has to be changed out, or wheels need replacing for any reason, the entire truck or trucks of a unit are changed out, regardless of mileage or months of service. This process will be repeated as occasion demands until the trucks proper required complete overhauling due to expiration of time or mileage. In the other system—known generally as the progressive system, wheels and motors are changed out on drop pit at times prior to the time for overhauling trucks under this class of power. The progressive system is more generally used by railroads.

It seems to be standard practice on railroads where the progressive system is used to remove multi-wear wheels after about 100,000 miles of service for necessary turning; to remove motors after 200,000 to 300,000 miles of service for inspection and necessary repairs; and to remove the entire truck after an average of 600,000 to 1,000,000 miles for repairs or replacement of bushings, pins, wear plates and similar parts.

The ideal system to be adopted on any railroad is the one where diesel units will be available the largest precentage of time. Generally there is a layover period of from 4 to 6 hours between runs at repair terminals for necessary running repairs, inspection, etc., so that with either system the item of availability will be fairly comparable.

Under the progressive system it is important that change-out terminals have sufficient wheels on hand to mate up with other wheels in the unit, especially wheels that are equipped with motors. If this is not carefully watched, wheel slippage will result making it practically impossible for controls to function, particularly when the speed of one driving wheel is not within reasonable tolerances with its mate. An unbalancing condition must inevitably result with miss-mated power wheels. Builders of diesel power generally recommend the difference in diameter of driving wheels shall not exceed 1 in. Filler blocks between equalizers and journal boxes should be applied where wheels of different diameters but within 1 in. are used so that the truck may be kept level. If this is not done, instead of bearing uniformly on center castings, there will be point contact only causing damage through the center casting which is part of the bolster. On EMD type F-3 frame units, the body bolster being the weakest construction, plates will work above center castings and cracks will develop. This is due to the close tolerances at wear plates between bolster and truck frame. These approximate 1/16 in. to the foot before binding sets up and unless filler blocks are installed damage inevitably results. In a previous section of this report it is stated multi-wear wheels require turning after about 100,000 miles. This figure can vary—based on reports at hand—from 90,000 to 200,000 miles it being generally admitted wheel wear will be much less on straight level road bed than it will be under operating conditions involving many curves and grades.

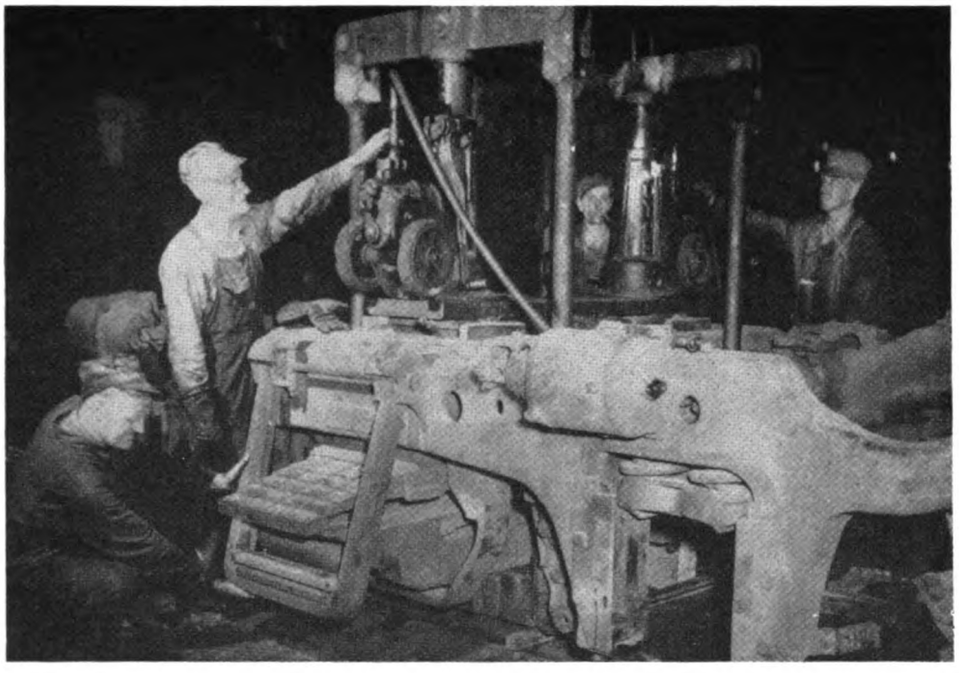
The question of investment in spare equipment and facilities in many cases is the determining factor in adopting one or the other of these two systems. It is admitted that if a truck can operate approximately 600,000 to 1,000,000 miles in passenger service and from about 300,000 to 400,000 miles in freight service without renewal of pins and bushings, pedestals, wear liners, frame, equalizer and swing hanger work, etc., or without making it necessary to strip the truck completely account of renewal or replacement of wear plates, etc., then under the progressive system of truck repairs the wheel and truck work having been handled at stated intervals, the work of repairing or rebuilding the truck is considerably simplified. However, under these conditions spare wheels for continuity of service must be spread over many points, advisedly terminal points on a particular railroad, with the same logic applying to motors, therefore more wheels will be required as compared with the system where entire trucks are changed out.

On roads where the entire truck assembly is removed whenever a failure of any type occurs, or when wheels are to be turned, etc., proper somewhat special equipment must be made available at change-over points and in addition considerable number of spare trucks, complete in all respects will be required involving a very large investment in this type of equipment, which condition is considerably aggravated by the different types, makes and services being performed by diesels on a given railroad. Conversely, the investment in spare equipment under similar conditions will be much less if the progressive system of repairing trucks is in operation.

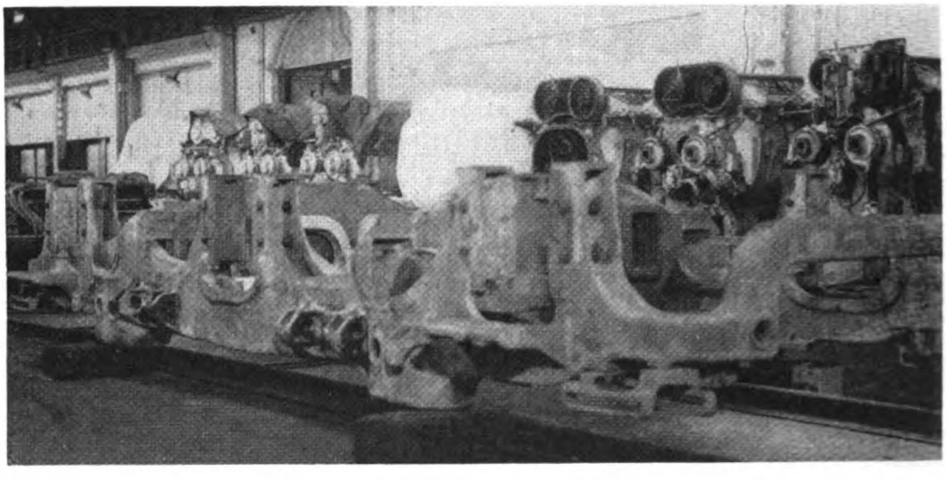
Generally swing hangers and equalizers receive attention during the major overhaul of trucks. Some railroads are reworking equalizers by electric welding to bring wear surfaces back to specifications or blueprint; others are reworking these parts in their blacksmith shop where they are heated and formed or forge welded so that after this work is completed they may be normalized, Magnafluxed and if found to be free from cracks, machined to standard dimensions at wear places. The latter practice is more generally followed inasmuch as it seems there have been instances where the electric welding process was used, cracks have developed in the equalizers. Swing hangers and safety guards are of course removed, normalized and Magnafluxed.

A permanent record of this type of work is stenciled on the repaired or reworked parts, particularly on roads using the progressive system, inasmuch as it may be necessary to change equalizers or swing hangers due to having been in service the required period of time. Extreme care must be exercised in placing the stenciling inasmuch as there have been instances where cracks developing after installation have been traced to the stenciling.

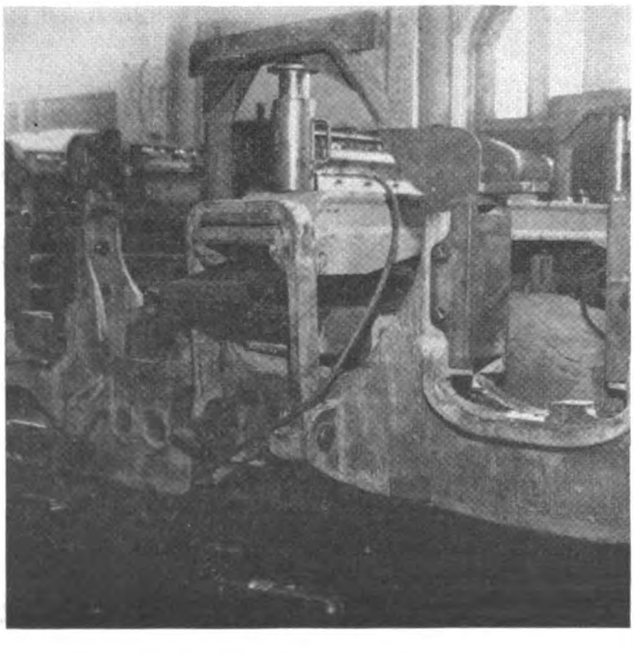
The remainder of this section of the report was made up of a number of illustrations showing facilities and practices involved in truck repairs. These accompanying this abstract have been selected as typical.



Rigging for compressing springs when dismantling or assembling four-wheel truck-spring hangers

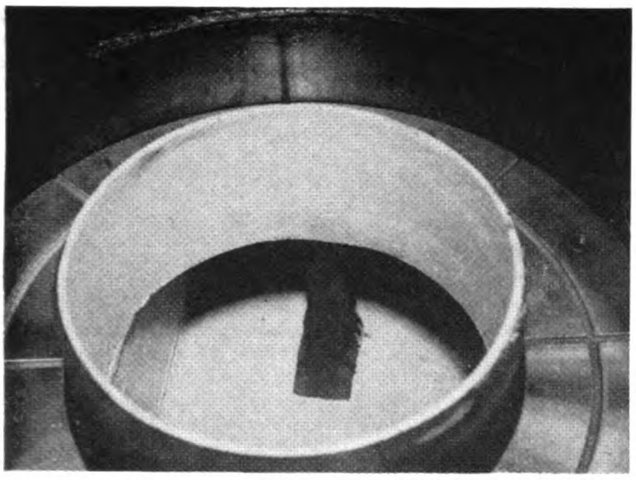


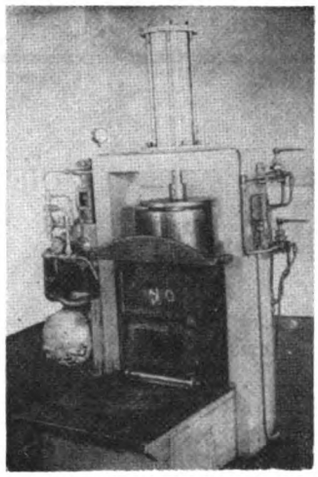
Many roads find it easier to apply coil springs and equalizers by turning the truck frames upside down which eliminates lifting the frames several times

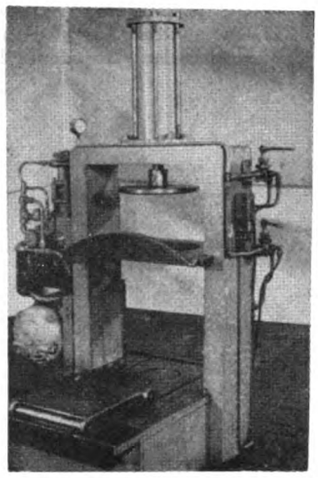


At the left a 50-ton hydraulic is being used to compress the truck springs while the pins are being removed or applied. By the use of this arrangement for lifting the weight of swing hangers and related parts when stripping or assembling trucks the job of handling the pins is simplified. This arrangement is considerably lighter than the one shown at the top of this page which needs a crane

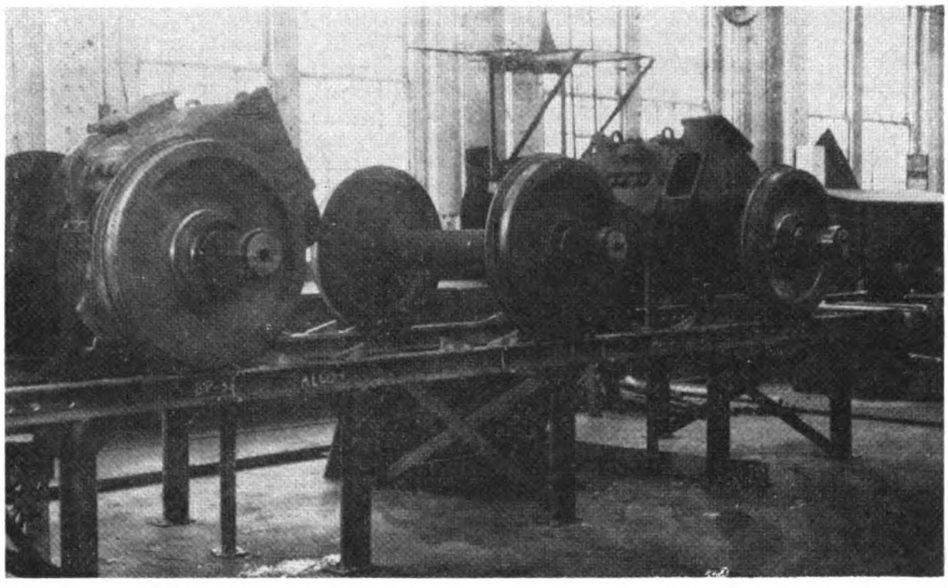
A 50-ton hydraulic jack is used for compressing springs while pins are being removed or applied



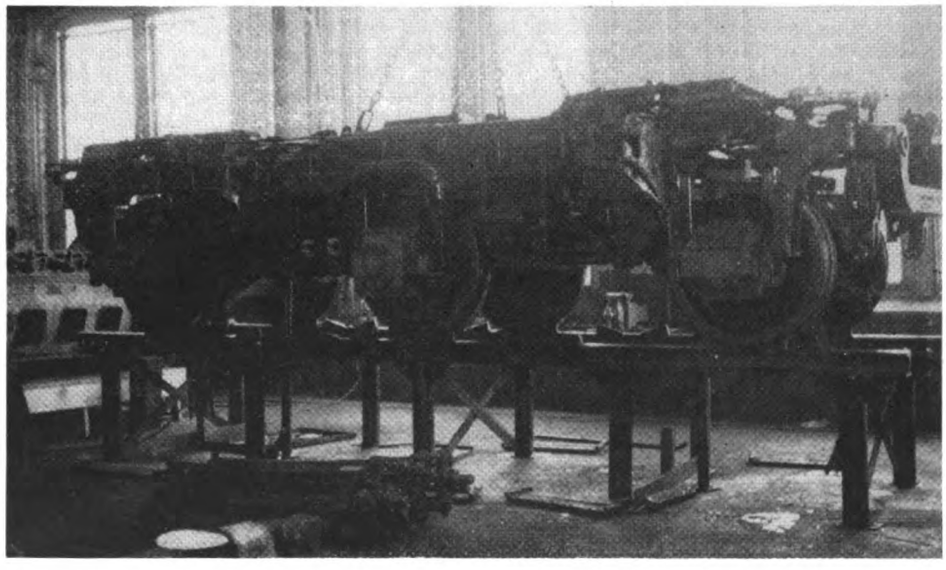




(Left) Because of cracks in bolster, reinforcing in the air duct was necessary. A 1-in. by 5-in. by 9-in. piece of steel was used as shown. (Center) Journal-box press used for removing and applying the outer races of bearings. (Right) Pressing the outer bearing race into a journal box



One type of truck repair stand is this elevated track which is about 3 ft. above the floor.



Here is a type of stand, similar to that shown in the above illustration, which is designed to handle a six-wheel truck

[This section, on truck repairs, was part of a report on shop practices submitted by a committee of which C. H. Spence, superintendent of shops, Baltimore & Ohio, is chairman. The remainder of the report dealt with the welding of diesel engine parts and consisted of 17 illustrations with appropriate descriptive material. These will appear in a subsequent issue.—EDITOR.]

Cleaning Diesel Locomotives

The exterior cleaning of diesel locomotives seems to present no serious problems. The trucks, underframes and fuel tanks can be easily cleaned by hot water under pressure or steam. This equipment is available in most cases as it was universally used on steam locomotives. If the build-up of grease on the trucks and underframe is heavy it would be advisable to spray with a solution designed to loosen this film. A good cleaning program will prevent this heavy build-up. One-half man hour per unit is ample in most cases for this cleaning. The engine should be operated in about the third throttle position so that traction motor blower air will help prevent moisture entering these motors. Care should also be used to keep the water or steam away from the traction motor openings. This cleaning should be done as often as possible and never less than once a month. The oftener cleaned the less time involved.

The exterior cleaning of the car body can successfully be accomplished in a number of ways with a minimum number of man hours or equipment. The number and kind of units will be the deciding factor. The washing machine will perform this work in a satisfactory manner on certain types of diesels, depending on the contour of the car body. A small amount of hand cleaning may be desirable at times for a real good job. The time element is small, but the cost of the equipment is large.

A home made process can cheaply be set up which consists of two vertical pipes with spray nozzles located about 8 inches apart, starting about 24 in. above the ground and which curve slightly over the top of the car body. The locomotives are passed through a wet-down line, then sprayed with a cleaning solution after which they are washed off with cold water. This is a satisfactory makeshift set up and requires only about 15 minutes per unit when the film is not too heavy. A small amount of hand cleaning is desirable for a good job.

Hand brushing and rinsing is necessary on some types of locomotives. This method does the most thorough job, but requires the most man hours. However, it can be performed inside the diesel facility while maintenance work is being performed. The type of cleaner used will depend upon the film present. Rinse with water, brush on the cleaning solution and rinse with water. The cleaning solution may be sprayed on if desired and then brushed. Two to three man hours will be required per unit.

Interior cleaning should be concentrated on as it presents the most serious problems. Too many man hours are used to accomplish an undesirable cleaning job in the engine room. The finished job may leave an oily film over all parts so dirt can be collected, and the inaccessible places usually neglected. Fire hazards and unsafe walking areas must be eliminated. We can expect the I. C. C. Inspectors to give these conditions closer attention in the future. The design characteristics of nearly all diesel locomotives leaves much to be desired for good interior cleaning. This should be given much future study. A further obstacle in the path of interior cleaning is the fact that work is usually being performed inside the diesel from the time it arrives until it departs.

Hand cleaning takes considerable locomotive time and man-hours to accomplish a good job. Twenty-four man-hours seems to be about the average time to do a good job on a Class F 3, E.M.D. diesel locomotive once a month. The tendency is to clean the easily reached places and make little or no attempt to clean the inaccessible locations. A good vacuum cleaner should be used first and all loose dirt and dust picked up. Then the ceilings, walls, engine and accessory parts should be cleaned with a good cleaning solution that does not leave an oily film. Last the floors should be cleaned. Brushes should be used and must be of proper design to reach inaccessible places. Rags and towels can be used to wipe clean and dry. Too much reliance is placed on the laborer being conscientious enough to do a good job. Supervision must give this phase closer attention.

This hand spraying method consists of spraying a cleaning compound, under light pressure, so as to wet all parts to be cleaned. It is then rinsed down with an air rinse gun. Little water is used, but the air velocity breaks the water into a fine mist. The idea is to penetrate into the cleaner and knock off the dirt and cleaner. While this method uses little water and does reduce electrical difficulties, it has the disadvantage of moving the foreign matter from one place to another instead of knocking it off on floor.

Another cleaning method is to use a hand spray with city water rinse. The cleaner is sprayed, at low pressure, over all parts to be cleaned. A garden hose is then used with city water pressure to rinse down the dirt and cleaner. With occasional hand brushing the unit can be thoroughly cleaned. The water can either be mopped up or taken up by vacuum. The electrical equipment should be protected with canvas shields. Two to three man-hours will be required per unit.

There is also the hand spray method with controlled knock-off rinse wherein the cleaner is sprayed on, under light pressure, to all parts to be cleaned. A rinse gun connected to both air and water is used to knock off the dirt and the cleaner. The amount of water is controlled to a required minimum to preform this work in a satisfactory manner. The electrical equipment need not be covered when this method is used, provided the work is being performed by a competent employee. The amount of water to be mopped up or vacuumed is small. A little hand cleaning and wiping will be required. Two to three man-hours per unit will be required.

When pressure spraying is used with a pressure rinse, the cleaner is sprayed on with about 90 lb. pressure over all parts to be cleaned and rinsed with water under the same pressure. The electrical equipment should be protected with canvas shields. The water can be taken up with a mop or vacuum cleaner. This method of cleaning tends to loosen the heavy coating when the cleaner is being sprayed on. With the coating looser it can be more readily rinsed off. A small amount of hand cleaning and wiping will be required for a good job. Two to three man-hours should give a satisfactory job.

To do a good job of cleaning, regardless of method, the following must be kept in mind.

1. The cleaning compound or solution must be "tailored to fit" the job. Every railroad has some peculiar operating condition. which may deposit a definite kind of dirt. The safety of the employee using the cleaning solution must be considered. The various companies making and selling cleaning compounds will be more than glad to demonstrate their products in a practical manner and help set up a definite cleaning program.

2. Supervision is a must. The average labor gang today is careless and indifferent. Proper supervision will offset this so a better job will be accomplished.

3. Cleaning must be a scheduled maintenance item and independent from all other work to be done.

4. The education of every man on the job should be and can be arranged with no loss of time. The men should know their job thoroughly. The lack of knowledge or carelessness can be costly.

5. Serious study should be made of the various cleaning jobs to fit the railroad's need. When a method is decided upon, the proper tools should be provided.

6. Where possible, natural layovers at points where little or no maintenance work is performed, should be used to the greatest extent possible for the interior cleaning program. Where there are several of these points definite parts of this program can be assigned.

7. Proper maintenance is of greatest importance for, no matter how good the cleaning program is, the benefits of it will be lost unless oil leaks are stopped, smoking steam generators corrected and all other sources of dirt eliminated.

The I.C.C. inspectors are aware of these conditions and make many inspections in bound.

8. Do not expect perfect results the first time a diesel is cleaned in 12 months. Once a diesel interior is properly cleaned, monthly cleaning with good maintenance should keep it clean.

9. The cleaning solution must leave a job, when finished, that is dry and film free.

10. Allow the engine to cool before applying the solution.

11. In all cases where spraying methods are used it is advisable to megger the electrical circuits before and after cleaning. The time required to do this is small and the protection great. Running the engine for an hour after cleaning will usually eliminate minor moisture grounds caused by the cleaning. In many cases the electrical circuits will show a benefit from the cleaning.

12. Make a study of the various types of locomotives to see if a few minor changes could be made that would be beneficial the cleaning program.

This is one part of a report presented by a committee of which L. L. Luthey, general supervisor of diesel engines, A. T. & S. F., was chairman.

Water and Oil Leaks

Water and oil leaks have been a source of trouble and expense from the first appearance of the diesel-electric locomotive resulting in severe criticism being directed toward the railroads while constantly battling the oil and water leaks. These leaks in some cases have been aggravated by poor maintenance originating from defective and improper materials as well as insufficient engineering design. The manufacturers and the railroads working together have made many improvements, however, there is still considerable work and engineering involved before such defects can be eliminated. Another burden presenting itself is that as the engine becomes older it is more apt to develop oil and water leaks.

Water and oil leaks became a major problem when the developments and improvements were made in certain moving parts of the diesel engines which allowed the diesel locomotive to be placed in an operative manner for a longer period between inspections or extended maintenance schedules. The seals and gaskets would deteriorate before the extended mileage had been reached, when heretofore the seals and gaskets were renewed before maximum service life had been reached due to replacement of various mechanical parts.

Water Leaks

The most common water leaks have been on the cylinder assemblies of the Type 567 engine. Water leaks have been experienced at the liner seals, head seals and cylinder head to liner gaskets. The lower liner seals have been changed to a white silicone type of seal costing approximately four times as much as the former synthetic rubber seals. Although this seal has eliminated most of the difficulty experienced with the lower liner seals, it's full savings cannot be realized due to the short life of the synthetic rubber upper liner seal necessitating removal of the liner and assembly before reaching expected life of the lower liner seal.

The cylinder head seals have been changed from time to time, both in material and size, the latest cylinder head seals being made of synthetic rubber. Changes have also been instituted in the cylinder head seal ring. At the present time very little trouble is being experienced with water leaks at this point, providing the cylinder assemblies are removed before reaching the maximum service life of the synthetic rubber head seals.

The cylinder head to liner gaskets have also been changed in design and materials. The latest gasket being a copper asbestos gasket with a zinc coated steel bottom surface with an annealed welded steel wire insert. Recent design cylinder head to liner sealing arrangement now being used consists of a ferrule and grommet water seal, the brass ferrules being contained in the liner water outlet passages by a light press fit and extending loosely into the cylinder head water inlet passages. Each tube is surrounded by a small doughnut seal of silicone material. With the use of this water seal arrangement, a solid copper gasket is used as a fire seal at the head to liner split for protection against combustion gas heat. This arrangement although not entirely new to the railroad diesel engine field, holds high expectations by the manufacturers for performance and possible increased assembly removable periods.

The above mentioned improvements in the sealing of assemblies is viewed with optimism by the railroads due to corresponding liner and head seals of synthetic rubber material having a maximum service life of approximately two years. The different resiliency characteristics of the silicone and synthetic rubber may also present it's problems before present maximum service life can be obtained.

Water leaks have been encountered due to the leaking exhaust manifold studs which protrude into the water jacket and on many of the earlier Type 567A engines cracks developed in the dead air space on the gear train end of the engine. This space being surrounded by water resulted in water leaking into the gear train thence into the crankcase. On many older engines cracking of the top decks allows water to enter the lubricating oil and if rigid inspections are not set up to detect this condition, usually results in loss of crankshaft or damage to the engine. These items are the manufacturer's responsibility and whether or not this difficulty has been totally corrected, remains to be seen. The design of the exhaust manifold studs protruding into the water jacket is basically unsound.

Water leaks are encountered on almost all types of diesel engines. On the Type 244B engines water leaks develop between the cylinder heads and liners at the rubber water grommets around the two water outlets from the liner to the cylinder heads. These rubber seals become hard and deteriorate due to their inability to withstand the normal operating temperature of the diesel engines. To overcome this difficulty it will be necessary for the engine builder to manufacture these seals from an improved material—probably silicone seals would be the answer.

Some difficulty has been experienced with cracked heads resulting in water leaks. It appears that this condition was brought about by improper water circulation through the core of the head and improper venting of the cooling system.

The Type V O diesel engines of the early design experienced water leaks at the liner seats in the blocks. The cylinder liners were originally designed for a loose fit in the top of the block and when the engine was under full load, resulted in excessive liner movement in relation to engine block, causing the ground joint between liner and block to leak. Building up the liner seats in the block with electric weld and remachining to accommodate latest body bound type of liners was quite costly but this modification has corrected the difficulty.

With the exception of the Type 244 and the opposed piston type road diesel engines, maintenance schedules have been set up to remove cylinder assemblies on a two-year basis for all diesel engines, without experiencing an unprohibitive amount of water leaks. The Type 244 engines are removed at each annual inspection due to other defects and engineering design changes. Recent engineering improvements of the main engine frame, the testing of cast iron pistons, better water circulation through the head and reventing of the cooling system, will probably contribute to longer piston and liner life. A few years ago we, on the Santa Fe, experienced a severe epidemic of water leaks necessitating taking engine cooling water several times enroute over a division. With proper maintenance, use of proper type, maintaining correct strength of water treatment and with the help of the locomotive builders, we have been able to eliminate water leaks and extend our cylinder assembly inspections schedules to two years. At the present time we have few reports of water leaks or engines taking water enroute and these conditions are thoroughly investigated and the cause and condition corrected.

External leaks commonly found around water supply tanks, pumps, radiators, water manifolds and various piping can readily be found by daily inspections. The majority of such defects can be corrected quickly by shop forces.

I believe it would be helpful if to take a few moments and cover the procedures followed on the Santa Fe, which have been helpful in eliminating water leaks.

The first and most important item is cooling water treatment. We use a sodium chromate water treatment, maintaining a 3 percent solution in the Alco and Fairbanks-Morse road locomotives and a 1 percent solution in other locomotives. In most road locomotives this treatment is used with distilled water. The comparator system is used for periodic checking treatment strength of the engine cooling water.

To help detect internal as well as external water leaks one should first establish a predetermined water level that the engine can be efficiently and safely operated on and then maintain that water level at all times. If this practice is followed and a locomotive arrives with a marked drop in water level, a close inspection is made to determine and correct the cause of water loss.

Proper maintenance is important in the elimination of water leaks. When a locomotive arrives at assigned maintenance terminals, a small amount of lubricating oil is drained from the crankcase sump each trip and if any traces of water are found, the engine is inspected for water leaks and the condition corrected, the lubricating oil is drained, main and connecting rod bearing removed and inspected. After existing defects are repaired the engine is load tested and inspected for additional water leaks. If reports are received on an engine losing water or water being added enroute, the engine is also load-tested and the defect found and corrected. When it is necessary to change a defective cylinder assembly, the foreman in charge must make a personal inspection of the air box, liner seats, cylinder head seats and the exhaust chamber for cleanliness and defects after the assembly has been removed and OK's the block and new cylinder assembly before application. On the next trip inspection, the rocker arms are removed and the cylinder head and crab nuts are tightened to proper torque values. When all cylinder assemblies are renewed, the cylinder head and crab nuts are tightened to proper torque values and the engine given a full load test for four hours and the rocker arms removed and the cylinder assemblies re-tightened. When the locomotive returns from its first trip, the rocker arms are again removed and the assemblies are re-tightened. Each quarterly inspection, all rocker arm assemblies are removed and the cylinder head and crab nuts checked and tightened to the proper torque values on all diesel engines. We feel that cleanliness, proper supervision, proper inspection, application, and the correct procedures of re-tightening the cylinder assemblies are very essential.

Oil Leaks

The maintaining of all types of diesel engines free of miscellaneous lubricating oil leaks is a major problem. This problem is more than a maintenance item and will require design changes and improved gasket materials before they can be entirely eliminated.

Oil leaks exist between the crankcase and oil pans, around the various housings and cylinder head covers. Some progress has been made toward correction by creating a vacuum on the crankcases by various devices, use of different gaskets materials, application of additional bolts and strengthening devices to the housings has helped to some extent. Re-tightening crankcase to oil pan bolts at certain inspection periods, has contributed little if any in stopping the seepage of oil leaks at the oil pan joint.

We have applied some special bolts in this application whereby we attempt to inject sealing compound into the joint internally. However, the material would not stand up and would last, possibly one trip.

Tests are being made on various gasket materials and sealing compounds made of silicone and plastic. These tests have not accumulated enough data to venture an opinion on their merits at this time.

At the present there is no permanent solution for oil leaks and it will be necessary to maintain engines to the best of our ability to eliminate this costly defect. It will be necessary to completely dismantle the Diesel engines and apply new gaskets when oil leaks exist and it is not possible to set up a maintenance schedule doing this work on a mileage or time basis. The builders have an important responsibility in this matter and should furnish us with the correct materials and design changes necessary to correct this condition as we are being severely criticized regarding the oil leaks.

On the Santa Fe oil dams have been applied consisting of strips of cold rolled steel welded to the floor surrounding the main engine, generator, air compressors, etc., as needed. This has confined oil within a certain area and has eliminated safety hazards. It has not fixed any oil leaks. We also wipe up engine rooms when locomotives pass through intermediate terminals where locomotives operate on extended runs. This has brought about a clean and attractive engine room. However, it is costly to the railroad.

Water and oil leaks are not altogether a maintenance problem, as we have been led to believe. The railroads have done much toward correction by proper maintenance, use of the proper materials and working closely with the engine builders. It is now reaching a point where the railroads have done all that is humanly possible toward the correction of water and oil leaks and it is the responsibility of the engine builders to correct the design of the diesel engines so that they can be properly maintained free of water and oil leaks with a reasonable amount of proper maintenance.

The above is one part of a report presented by a committee of which L. L. Luthey, general supervisor of diesel engines, A. T. & S. F., was chairman.

Wayside Servicing Facilities

It is just as important to locate and design adequate wayside facilities as it is to install a large plant for maintenance and servicing of locomotives.

The points that must be given consideration before the proper arrangement can be planned are (1) the number and type of locomotive units to be serviced (2) location and the effect on the proposed layout of the expanded use of diesel locomotives or the complete dieselization of a railroad.

It must be considered that steam facilities may be completely abandoned in the future and that consequently they may not have too important a bearing on the location of the wayside facilities.

An important factor in selecting the location for the wayside facilities is that the locomotive should remain close to the point where it is operating. The large initial investment as well as potential earning power makes it imperative that the time spent in a moving locomotive to or from the servicing point should be held to a minimum.

In large industrial areas where there may be considerable switching or short movements, it may be well to consider a mobile servicing unit that can be dispatched from a main terminal point.

For this purpose, two types of units can be secured. One is an autocar that has proven successful on several railroads. The second is a refueling car that could be dispatched in the same manner.

The autocar provides a system of refueling and resanding diesel locomotives without requiring them to be brought into terminals or other fixed location service stations. They could operate in fleets of two or more and cover three points of two diesels each or five or six points of one diesel each in a radius of approximately 10 miles every third day. There are many

possibilities with this truck and it eliminates the necessity of a large number of small servicing points and an increase in personnel to operate them.

With the refueling car the possibilities are the same as with the autocar but it can cover a much larger radius with longer intervals of time. The capacities of this car are greater and it can be used on a more permanent location basis but still mobile if situations require a change in location periodically.

Cars could be dispatched in fleets from a main terminal point and inventory in oil disbursements controlled as required.

In long road freight or passenger service where formerly the locomotive was cut off from the train and moved to a servicing point, either of the cars permit spotting them in the location where the through train could be stopped and in a short time be on its way.

At a large wayside servicing point the facilities should provide sufficient storage for at least a 30-day supply of fuel oil. The fuel oil should be filtered and metered with adaptable quick operating couplings and connections.

An accompanying drawing shows a refueling package unit developed for the Reading by a Philadelphia firm.

The unit is an all-welded steel cabinet built on an angle-iron frame and mounted on a channel base measuring 5 ft. high by 5 ft. wide by 3 ft. deep.

The equipment inside includes an 85-100 g.p.m. self-priming centrifugal pump with a 7½ hp. motor or a rotary positive displacement pump with a 5 hp. motor; a pipe line strainer to protect the pump; a removable cartridge filter; a rotary meter with large numeral register and ticket printer to record the number of gallons delivered with a prefix and a suffix to indentify the location and type of oil (the meter can be provided with a set-stop mechanism that can be used to handle the oil in exact amounts); ball-bearing hose reel; 50 ft. of 1½ in. synthetic hose, quick operating nozzle; cam operated quick coupling; aluminum filter; explosion-proof light and motor starting equipment with push button control and door actuated switch. Piping and valves permit pumping from tank car to storage tank or storage tank to diesels or tank car to diesels.

Estimate and Requirements

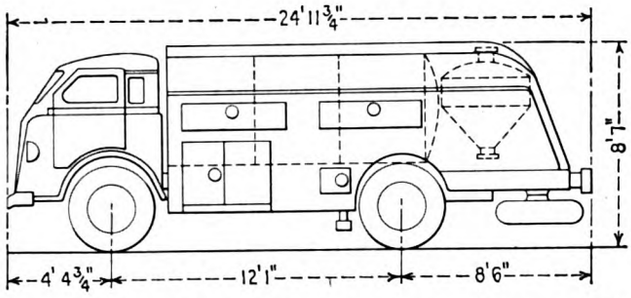
When capacities are figured for storage at various points it is comparatively safe to use 6 gallons per hour for 1,000 hp. switchers or less and 8 gallons per hour for 1,600 hp. switchers. For road diesels the basis can be on 2½ to 3 gallons per mile.

Storage tanks should be constructed in accordance with American Petroleum Institute or National Board of Fire Underwriters specifications and be surrounded with a concrete or earth dike, especially if near streams or other property, as a safety measure.

Sanding facilities usually consist of a sand tower in 3-ton, 5-ton or 10-ton capacities with hose connections to service all types of diesels.

Investigation may prove that the sand could be purchased much cheaper dried and cleaned than the wet sand could be processed through a dryer, especially at a small point. If so, it should be transported in a converted cement car and dumped in a bin and conveyed to a dry storage bin.

However, if personnel is available, an automatic oil burning



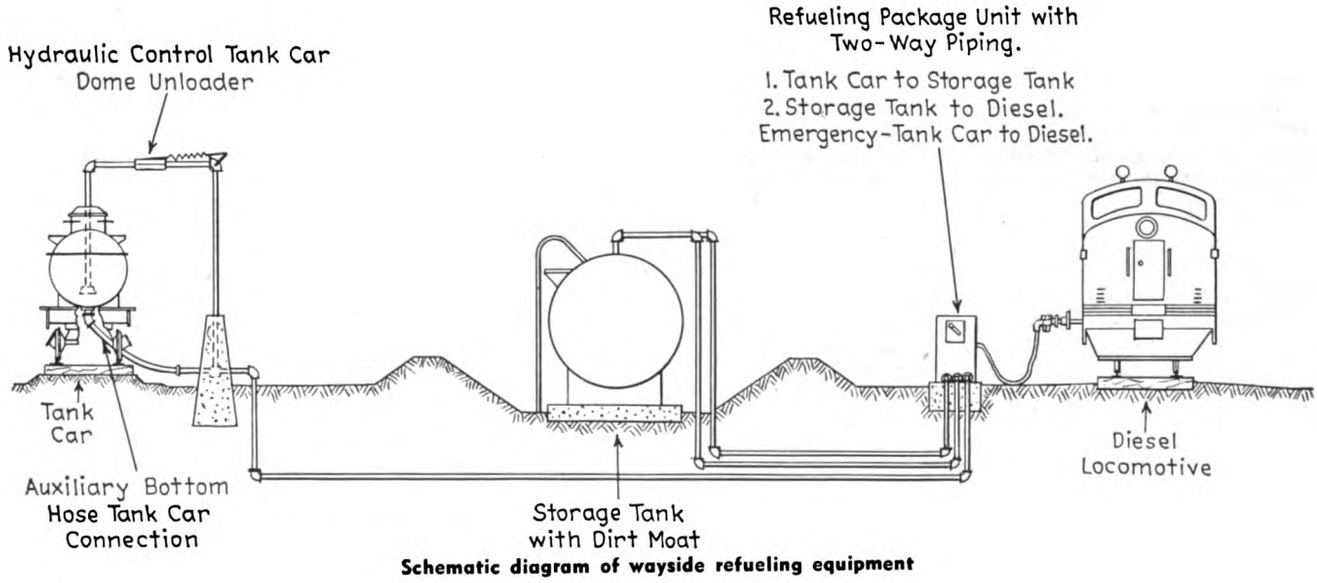
Fuel oil capacity, gal.	1,500
Sand capacity, lb.	2,000
Rate of refueling, g.p.m.	50
Rate of sanding, lb. per min.	100
Gross weight, lb.	30,000
Wheel Base, in.	145
Front Axle load, lb.	10,000
Rear Axle load, lb.	19,996
To conform with 18,000-lb. capacity in some states:	
Oil capacity, gal.	1,230
Rear axle load, lb.	18,000

Oil is pumped from the tank by a power take-off from the truck engine, using equipment similar to that employed on household oil delivery trucks.

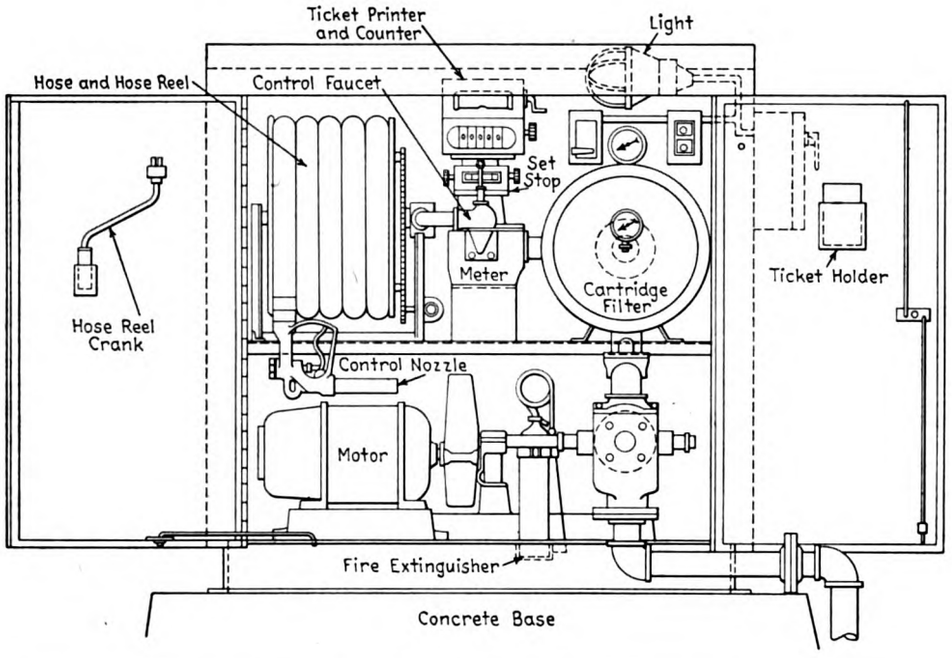
Sand is fed by gravity into a pressurized chamber conical hopper, and is blown into the discharge line by an air jet at the point of discharge. An air dryer has been introduced into the intake air line to prevent moisture being carried to the sand. Compressed air is obtained by connection to the brake pipe on the locomotive being serviced.

The service truck is equipped with cabinets for lubricants.

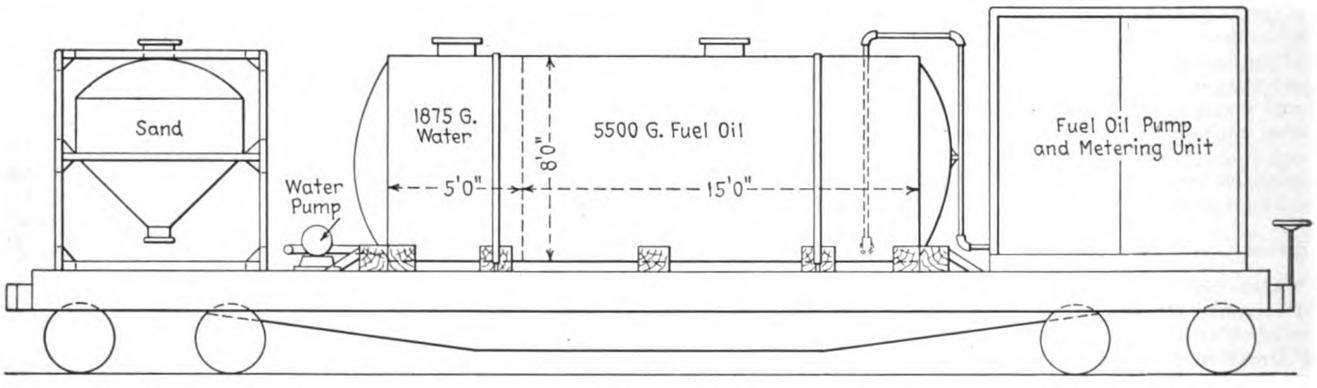
Automotive type refueling and servicing truck for highway operation



Schematic diagram of wayside refueling equipment



Diesel refueling unit as developed for the Reading



Fuel oil capacity, gal.	5,500
Sand capacity, lb.	4,000
Rate of refueling, g.p.m.	90
Rate of sanding, lb. per min.	100
Water capacity, gal.	1,875
Rate of water, g.p.m.	50
1—50-gal. lube oil drum	
1— 5-gal. lube oil filler	
1—box of tools	
1—hinged ladder	

The oil is pumped from the tank by a pump in the diesel refueler. Power to operate pump can be from an outlet located at a point where the car is assigned or from a small diesel engine mounted in the back of the refueler.

Sand is fed by gravity into a conical pressurized chamber hopper, and is blown into the discharge line by an air jet at the point of discharge. An air dryer has been introduced into the intake air line to prevent moisture being carried to the sand. Compressed air is obtained by connection to the brake pipe on the locomotive being serviced.

Water is pumped by a motor driver centrifugal pump with power from the same source as used for fuel oil pumping.

Lube oil is handled in 50-gal. drums mounted on saddles and handled with a 5-gal. can provided with a special nozzle to fill diesels.

A ladder is mounted on the car with hinges to position it when the car is on location.

Rail car and equipment for servicing locomotives

dryer could be utilized, since a supply of fuel oil is available.

The use of conveyors reduces sand handling to a minimum and eliminates the costly expense of hand labor.

Lubricating oil can readily be handled in drums.

At locations where a large number of locomotives are handled and a certain amount of emergency repairs performed, an inspection pit on an outside track or inside a building in colder sections of the country is very desireable for work on trucks and traction motor equipment. The inspection pit should be long enough for a complete locomotive, be well drained and provided with adequate lights in pits and outside. Preferably the inspection pit should be enclosed or covered with a shed roof.

Water should be available for steam heat boiler used on passenger locomotives and make-up in engine cooling system.

Electric outlets should be provided and immersion heaters installed in diesels to keep units from freezing in extreme cold.

In general, a wayside plant should be planned and designed to receive a locomotive and dispatch same in the shortest possible time. The diesel has presented the railroads a chance to increase their available time and reduce detention time to a minimum. To do this, a locomotive must be serviced quickly, efficiently, and completely in the safest manner.

This report was part of a presentation of a committee of which H. E. Niksch, master mechanic, E. J. & E. was chairman.

Today's Mechanical Problems

In address at the president's luncheon J. M. Budd discussed hot boxes, materials situation, and manpower problem

J. M. Budd, president, Great Northern, in making the principal address before the coordinated luncheon on the second day of the meeting directed his remarks at three outstanding mechanical problems: hot boxes, diesel fuel and the materials situation and, in the discussion of these said, in part, as follows:

"Of all the purely mechanical problems of railway operation today the hot box situation is the most serious—an evaluation that, I am confident, no informed person will challenge. The operation of freight trains at higher average speeds, with higher average loads per car, and at greater distances between stops has increased the incidence of the hot box.

"The days and miles of car service lost because of hot boxes is appalling. Even though journal box packing specifications were altered effective January 1 of this year as a result of the action of the A.A.R. General Mechanical Committee, and the journal box repack dates advanced to a 12 month period and A.A.R. inspection forces increased to more vigorously patrol and enforce the rules and practices pertaining to journal box care, there has not been an appreciable improvement in the overall freight car journal box performance record. For the first 6 months of this year the number of freight car miles run per hot box for cars set out between terminals averaged 175,520 miles, with 98,076 freight train cars being set out of trains between division terminals on this account.

"That individual lines must become more vigilant in the servicing of journal bearings in addition to revising and strengthening rules and practices to permit proper attention to journals prior to departure of freight trains is, I believe, obvious. But, that is not and cannot be the whole or acceptable answer to the problem.

"A marked reduction in the incidence of the hot box can be achieved only after determination of the major contributing reasons for the increase; and, I am completely confident that the mechanical officers and their staffs on most railways already are giving the situation substantial attention. The hot box problem is not, in my opinion, a condition for the sole concern of the railway industry. The railway supply field must share the responsibility for development of a workable remedy.

"Another situation of growing concern to railway mechanical departments and builders involves the diesel locomotive, and is a development of the nation's defense program. The wide use of diesel motive power has placed the railways generally on an oil economy, and so long as the proper or ideal fuels are available, combustion and attendant problems are not of great consequence.

"However, the increasingly large appetite of the defense program for refined petroleum products must be of concern to both railways and builders of diesel motive power. Not enough information is available as to the quality of fuel that can be utilized for diesel operation. Like all machines, the diesel has limitations; so we should be conducting tests, individually, and in collaboration with the locomotive builders and the oil industry toward development of factual information on what changes would be necessary should railways be forced to use fuels of lower quality than at present.

"A third subject for comment and consideration is one with which everyone in this room is unpleasantly familiar—the critical materials situation.

"What has happened to the railway industry in the allocation of sufficient materials, steel particularly, for the construction of new cars and locomotives, and the maintenance of equipment in use, thus far has been thoroughly disheartening and unjustified. Considering the repeated acknowledgments of the railways' vital role in the defense effort and their importance to the efficient handling of their domestic responsibilities, their treatment to date in materials allocations has led to the reasonable suspicion that we have been kissed on one side and kicked on the other.

"A question which presents itself is whether or not critical materials deliberately have been withheld from the railways and, if so, for what purpose.

"Whatever the answer to that question, the condition exists. While we can only pray the condition will improve, it necessitates the greatest possible economy of every pound of critical metal and other materials in every railway shop in the country. Keeping in service parts that are safe although somewhat worn is one recommended contribution to licking the materials shortage. Another is increased salvaging of useful parts from dismantled equipment. And, experimentation with substitute materials could be stepped up.

"I am not assuming, of course, that economy of hard-to-get materials is being overlooked, but, I feel that something can be gained by emphasizing at this time the necessity for a more intense, far-reaching program of conservation of critical materials, machines and tools. Education of shopmen is the keystone of successful economy, and I am positive that the leadership of mechanical officers and their supervisory forces in a program of planned conservation would be impressively productive.

"It also is recommended that mechanical departments consider continued standardization of design of passenger cars and other rolling stock. Designs which will decrease the incidence of corrosion are of particular value and emphasis, for the corroding of metal is, as everyone here knows, a major contributor to deterioration of equipment and adding materially to maintenance and repair expense. Much headway has been gained by mechanical departments in combatting this problem, but I am sure that none will disagree with the statement that much remains to be done.

"Another subject for your consideration is the manpower problem in railway mechanical departments and others identified with operations. The continuing loss of young men to military services through selective service or voluntary enlistments induced by the draft, is creating difficulties with which you are aware.

"The age factor is a vital one in training of young men for jobs in the mechanical departments of railways, and present laws are not helpful to training programs. The present draft laws reduce the availability of young men within the apprentice age limits, and that seriously cripples training programs involving the handling and maintenance of modern railway equipment.

"Closest attention to the manpower situation and its relationship to employe training and military requirements is of constant necessity; and, in addition, we must continue to insist at every opportunity that railways be given equal consideration with other industries in the availability of manpower.

"'Cost' is a vital word today and in the future of the railway industry. Without sacrificing, but preferably with an improvement in the quality of our product, we must find ways of reducing our manufacturing costs. One of our large items of cost is the maintenance of equipment.

"New ideas . . . new methods . . . new tools . . . new metallurgical developments will come. We will have to venture into uncharted waters at times; but we must go forward, for standing still is as bad, if not worse, than going backward.

"I leave with you this question: 'What will the next generation of railwaymen inherit from their predecessors?'

"The answer to that question is this generation's responsibility!"

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ELECTRICAL SECTION

Electrical Sections Hold Joint Sessions And Meet With L.M.O.A.

Addresses, reports and discussions indicate that railroads are now trying to perform a big electrical maintenance job with too few facilities and inadequately trained personnel

THE annual joint meeting of the two A.A.R. Electrical Sections was called to order in the Hotel La Salle, Chicago, on Monday, September 17, 1951 by Chairman (*Electrical Section, Engineering Division*) H. F. Finnemore, chief electrical engineer, Canadian National. Having welcomed members and guests, Mr. Finnemore spoke of the proposed joining of the two sections. He said that both groups had endorsed the consolidation and that the subject was now before the Board of Directors of the A.A.R. for final approval. It calls for a complete new section and the employment of a full-time secretary. In view of the situation in the railroad industry, he emphasized the importance of increasing the membership of the sections by bringing in younger men.

Chairman (*Electrical Section, Mechanical Division*) L. C. Bowes, electrical engineer, Chicago, Rock Island & Pacific, said the reports represent much time and effort that the least the members present could do was to participate in discussion. He laid stress on the responsibility of electrical departments and said the air conditioning of passenger cars alone had doubled electrical maintenance, while diesel locomotives had multiplied it several times. Most of the equipment, he said, is highly specialized and requires much in the way of carefully selected and trained men. He concluded by saying: "Recognize your responsibility when you are called upon to be a member of a committee."

Election of Officers

Officers elected by the Electrical Section, Mechanical Division, were as follows:

Chairman: H. C. Paige, assistant mechanical engineer, New York, New Haven & Hartford.

Vice-Chairman: R. I. Fort, assistant research engineer, Illinois Central.

Second Vice-Chairman: C. W. Nelson, electrical engineer, Chesapeake & Ohio.

Members, Committee of Direction: P. H. Verd, superintendent of motive power and equipment, Elgin, Joliet & Eastern, and E. J. Feasey, general supervisor diesel equipment, Canadian National.

Officers for the Electrical Section, Mechanical Division, will be elected by letter ballot.

Wire, Cable and Insulating Materials

The report of the Joint Committee on Wire, Cable and Insulating Materials was presented by Committee Chairman C. R. Troop, assistant engineer, New York Central. The major part of the report consists of five specifications respectively, for: (1) Rubber insulated braided cable for train lighting and air conditioning service; (2) Rubber-insulated polychloroprene sheathed cable for train lighting and air conditioning; (3) Multiple-conductor, extra flexible portable cable for air conditioning and battery charging; (4) Single-conductor, varnished cambric-insulated, 0-1,000-volt, braided cable; and (5) Single- and multiple conductor varnished cambric-insulated, lead-covered cable.

The report was submitted by a committee of which C. R. Troop, assistant engineer, New York Central was chairman.

Discussion

C. A. Williamson (T. & N. O.) asked if the choice of strand size in the specifications had been made because of limitations created by critical material. Chairman Troop (I. C.) said, No, that the 7-strand wire is considered sufficient, but that 19-strand wire is okay if the user prefers. Roy Liston (A. T. & S. F.) said he believed that nearly all roads use 19-strand wire, and expressed the opinion that it should be included in the specification.

W. S. H. Hamilton (N. Y. C.) asked if others had used solid neoprene-insulated wire for control circuits and Mr. Liston replied that he had made tests with the aid of the DuPont Company with results so satisfactory that on the Santa Fe they use it exclusively when it can be obtained. He added that most of the wire they are now using is neoprene-sheathed, but that solid neoprene wire would be satisfactory if available. K. H. Gordon (P. R. R.) reported some trouble caused by the damaging of neoprene insulation in rough conduit. Mr. Liston reported that fuel oil will damage neoprene, but that it is not affected by other oils. To this Mr. Hamilton replied that he had observed some swelling of neoprene in contact with fuel oil, but had never seen any evidence of failure from this cause. S. R. Negley (Reading) suggested that further information on this subject be obtained from the manufacturers.

Electrical Section—Engineering Division
Association of American Railroads

Officers

H. F. Finnemore, *Chairman*, chief electrical engineer, Canadian National, Montreal, Que., Canada

C. A. Williamson, *Vice Chairman*, electrical engineer, Texas & New Orleans, Houston, Texas

N. D. Howard, *Secretary*, Electrical Section, Engineering Division, A. A. R., Chicago



H. F. Finnemore



N. D. Howard



C. A. Williamson

Power Supply

The report of the Joint Committee on Power Supply covers six assignments, as follows:

1. Power Supply for Engine Terminal Facilities, Including Special requirements for Diesel Locomotives

By R. H. Herman

The use of lights in a diesel locomotive cab for illumination while the locomotive is in the shop for repairs or during layover time at terminals results in a serious drain on the battery. This is particularly true if the layover time is long, the engine is not operated, and the battery is in poor condition. The battery may be drained to such an extent that it does not have capacity to start the engine, with consequent delays until it can be recharged.

Lighting on most diesel locomotive units is supplied from the 32-cell battery at 64-vots d.c. If a.c. energy is to be supplied direct from the shop distribution system, it would be necessary to install completely independent systems in each shop operating at 64 volts. Inasmuch as practically all diesel shops now have a 115-volt, single-phase circuit with receptacles at convenient points for extension cords and electric tools, it is more desirable to install stepdown transformers on the locomotive units themselves to operate from a nominal 115-volt source.

The equipment required on the locomotive is covered on pages ES-G-38 and 39-1947 of the Manual, Electrical Section. Mechanical Division, and consists of the following:

(1) A 1 ½ kva., 60-cycle, single-phase, air-cooled transformer. 115/230-volt primary, 75-volt secondary, with full capacity tap at 60 volts, and with primary windings connected to operate from a nominal 115-volt source of power.

(2) A double-pole double-throw switch with circuits on the locomotive arranged to permit connecting the lighting circuits either to the power supply on the locomotive or to outside supply through the transformer.

(3) Two receptacles on each locomotive unit, one on each side, located under the cab frame. The receptacles shall be 30-amp. capacity with three male contacts, the bottom contact to be grounded through the jumper cable. Receptacle housing to be insulated from base to prevent excessive current in ground wire due to potential differences in electrified territory.

(4) The recommended plug, as well as the receptacle, is shown on page ES-G-39-1947 of the Manual.

It is desirable that the double-throw switch be located and connections made adjacent to the lamp regulator so that all lighting, including headlight, classification lights, gage lights, etc., will be energized. This will facilitate detection of burned-out lamps by electrical inspectors.

The general arrangement of the shop distribution system, location of receptacles and panelboards, and whether power source is 115/230-volt, 3-wire, 115-volt, 2-wire, or 120/208-volt, 4-wire grounded neutral, will depend upon conditions at the particular shop.

In a typical installation on a large eastern railroad, energy is distributed to circuit-breaker type panelboards at convenient locations by 4-wire, 3-phase, 120/208-volt grounded neutral service. Each panelboard controls five circuits, each with a 35-amp., single-pole breaker and solid neutral. All wire between panelboard and receptacles is No. 8 insulated wire.

Two receptacles in a common box are located on columns under the working platforms, 28 ft. apart, to serve the working tracks on each side. Each 35-amp. circuit from the panelboard supplied two receptacles, but not the two receptacles at the same location. For example, the first two receptacles may be on circuits 1 and 2, the next two on circuits 1 and 3, and the last two on circuits 4 and 5. In the same manner, circuits 1 and 4 may be on phase A, circuits 2 and 5 on phase B, and circuit 3 on phase C. With this arrangement, satisfactory operation is secured by using No. 8 wire, single neutral, and the load is divided between phases.

In diesel shops with more than two tracks it will be necessary to provide receptacles and a distribution system under the working platforms between every other track.

The receptacles to be used in the shop installation should be 30-amp. capacity, 3-pole, grounded through the shell and extra pole. Portable cables should be of sufficient length and equipped with plugs on the one end to suit the receptacle on the locomotive and on the other end to suit the shop receptacle.

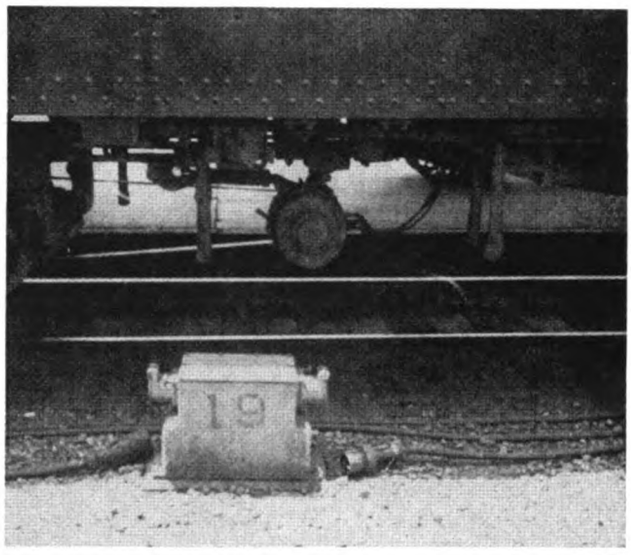


Fig. 1—One of the new 100-amp. double receptacles and the metal housing

2. Standardization of Plugs and Receptacles

By G. L. Sealey

The manufacturers of wayside receptacles and plugs for precooling facilities and battery charging advise that the use of circuit-breaker wayside receptacles is continually increasing and that this type receptacle has been used in the majority of the larger installations which have been made in the past year.

The majority of the breakers are equipped with trip units of the magnetic type, which eliminate trouble previously experienced with the thermal magnetic types when they are exposed to the heat of the sun.

Insulated plugs of bakelite and rubber construction are used in the majority of intallations in preference to the metal plugs, and the use of the "Snap-out" safety adapter is increasing.

One manufacturer has introduced a metal nut and anti-friction washer which is placed on the end of the bakelite plug as a protective measure where plugs are hammered into the car or wayside receptacles. Another manufacturer has introduced a right-angle battery charging plug for use where space between car receptacle and platform is limited. This manufacturer claims that this plug has the advantage that it can be inserted in the receptacle where the longer, straight-type connector cannot be readily inserted.

3. Yard Electrical Distribution System At the Birmingham, Ala., Terminal

By H. A. Hudson

Because of the increasing number of new streamlined passenger cars being operated through the Birmingham Terminal Station, Birmingham, Ala., it was necessary for the Terminal Company, early in 1950, to replace the original yard electrical distribution system for station tracks with a layout having sufficient capacity to operate the 25-hp. standby motors on the new passenger equipment and the 10-hp. motors on the mechanically activated air-conditioned Pullman cars.

The original installation consisted of a limited number of 60-amp., yard receptacles with a 240-volt, 3-phase distribution system, which was fed from a power service located a considerable distance from the yard receptacles. Therefore, in order to provide ample capacity for anticipated loads and to secure the operating advantages of more conveniently located yard receptacles, it was decided to replace the original facilities with an entirely new system.

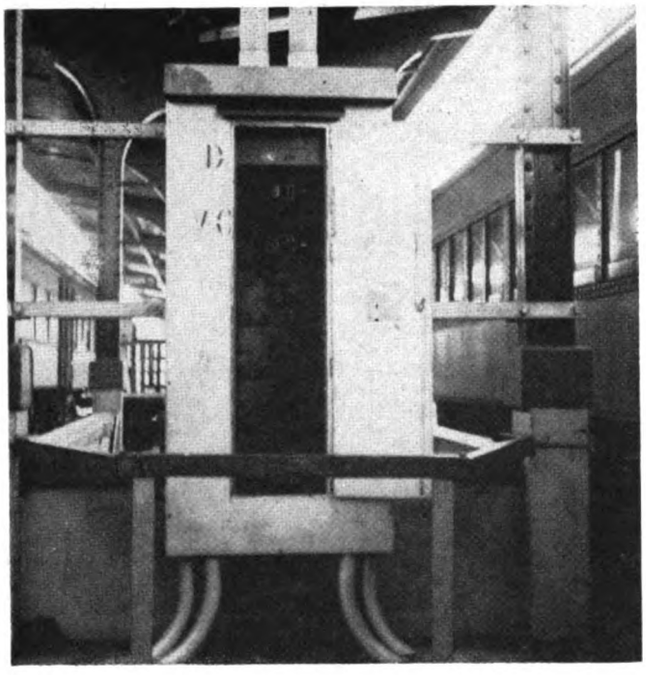
The new installation includes thirty, 100-amp., 4-pole double receptacles and 10 of the original 60-amp., double receptacles. (A yard layout included in the report is not reproduced here because of its size.) The 100-amp. receptacles are equipped with 100-amp. breakers, with a reset button on the outside of the receptacle housing. Fig. 1 shows one of the new 110-amp. double receptacles and the metal housing. Type G, Super Service 3-conductor No. 4/A.W.G. cable is used for the portable cords for connecting the cars to the yard receptacles. This cable has three ground wires made up with fillers. Standard 8-ft. Copperweld ground rods were installed at each yard receptacle. Therefore, the ground wire in the portable cords insures that all cars are effectively grounded when connected to the 240-volt distribution system.

At a point near the center of the load, a steel cabinet with six 400-amp. industrial breakers was installed under one of the platform sheds. The receptacles are divided into six groups, and each group is connected to one of the 400-amp. breakers in the switching cabinet. The grouping is so arranged that all of the cars of any one train will not be connected to one circuit. This prevents a possible overload in case a train with a larger number of 25-hp. cars is being serviced on one track. Fig. 2 shows a front view of the switch cabinet.

The undergound cable used between the main switch cabinet and the yard receptacles is 3-conductor, 500m.c.m., with a neoprene jacket. Smaller cable is retained on some of the 60-amp. receptacles which were not disturbed by the new installation and left at secondary locations.

To provide a power supply near the center of the load and thereby avoid excessive voltage drop, a transformer station, consisting of three 167-kva. transformers, was erected above one of the platform sheds near the main switch. Because some wood is used in the shed construction, and to avoid a possible fire hazard in the event of an explosion in a conventional oil-filled transformer, askarel-filled transformers were used. The primary windings of these transformers have a rating of 13.2 kv., and the secondary windings, 240 volts. Fig. 3 shows a view of the transformer station.

The main service from the power company which supplies the entire terminal is a 13.2 kv. closed delta system. The service point is located approximately 700 ft. from the transformer station, over the platform shed. Thus, it was necessary to extend the 13.2 kv. service line for this distance. On account of tracks, sheds and other obstructions, it was impracticable to install an open-wire distribution line for this service. Therefore, a 3-conductor, No. 4 A.W.G., 15,000-volt aerial cable, with ambrac tape and asbestos braid, was installed for the tie line between the transformer station over the shed and the main power service. This cable was suspended on a ⅜-in. Copperweld messenger wire. The cable was terminated at both ends by means of type F



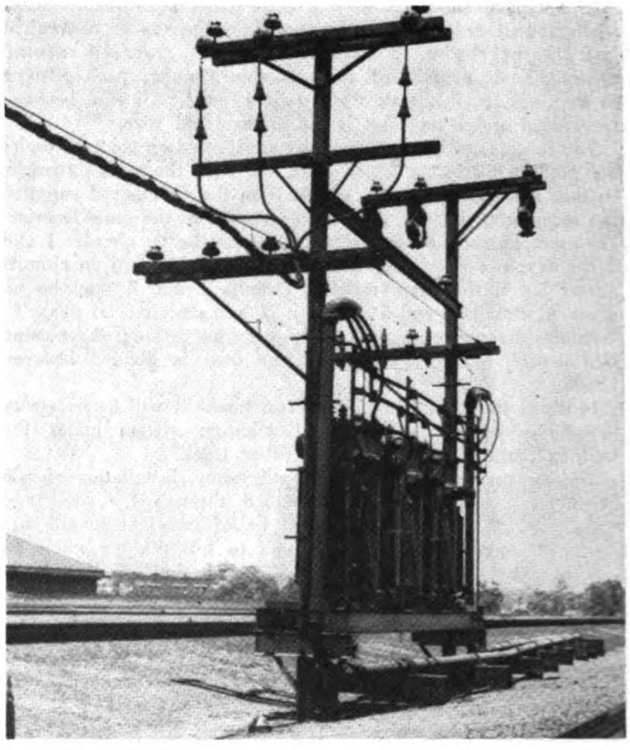


Fig. 2 (Left)—Front view of switch cabinet. Fig. 3 (Right)—Transformer station, erected above one of the platform sheds

shields. Two shields per conductor were used to prevent possible leakage in the event cinders or smoke settle on the shield.

4. A. C. Standby Distribution System At the Washington, D.C., Terminal

By R. E. Hauss

The Washington Terminal, like other terminals, was faced with the problems of servicing cars with large motor-generator sets. In order to provide suitable service, they have installed 100-amp., 240-volt outlets with built-in circuit breaker on 80-ft. spacing along each track in the passenger station. Since there are 20 tracks on the upper level and 10 on the lower level, the magnitude of this installation can be readily seen.

The existing 60 and 100-amp. fused single receptacles were replaced by 100-amp., duplex circuit-breaker type receptacles where there are double tracks between platforms. This is illustrated in Fig. 1. The concrete box on which the receptacle is sitting is hollow and serves as a junction box. This concrete box, in turn, is bolted to a concrete pedestal in which potheads are used to seal off trench lay cable. The old outlet can be seen to left of box.

On single tracks, due to insufficient clearance, 100-amp. single circuit-breaker receptacles are recessed into the side of the platform, as illustrated in Fig. 2.

The old fused receptacle box can be seen just to right of the new receptacle.

There are seven transformer stations in this area. Of these, three are new installations. Three of the vaults are at the south end of the station tracks in the tunnel area, two are on the lower level, and one is in the passage below the upper level. The other four are at the north end of the station.

The distribution to these transformer stations from substation is 2,300-volt, 3-phase, 60-cycle, delta. The disconnects at the transformers are electrically interlocked with circuit breakers in substation so that it is impossible to open disconnects with the line hot.

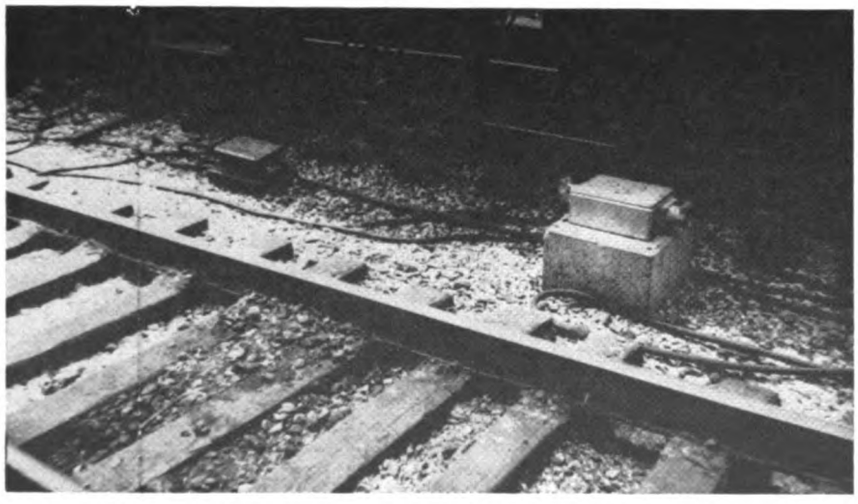


Fig. 1—Where there are double tracks between platforms, the existing 60 and 100-amp. fused single receptacles were replaced by 100-amp. duplex circuit-breaker type receptacles

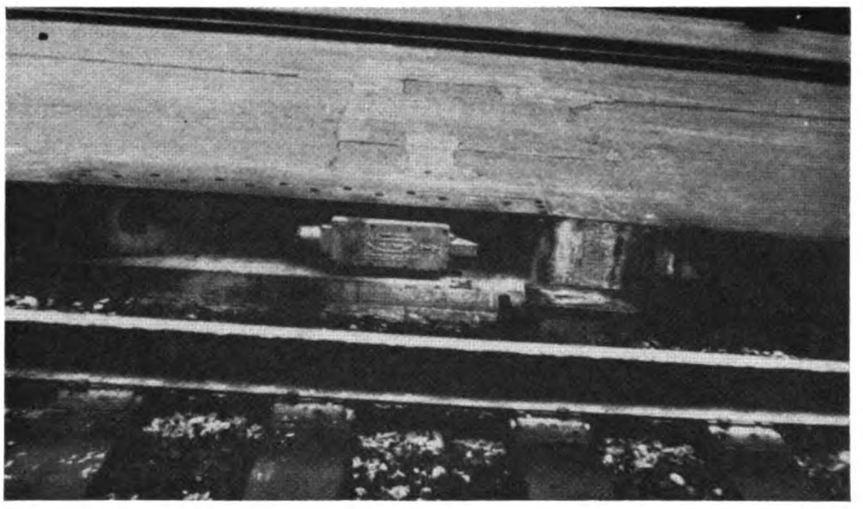


Fig. 2—On single tracks, the 100-amp., single circuit-breaker receptacles were recessed into the side of the platform

The 240-volt secondary lines from the transformers on the east side, upper level, are in Transite ducts atop the wall between the upper and lower level, as shown in Figs. 3 and 4. Since the individual circuits drop off at 80-ft. intervals under ground, and loop into and out of the receptacles half way across the station tracks, no one circuit will serve more than one car in any single train. The underground cable for the most part is trench-lay cable, and is in ducts only where conduit was pushed under platforms.

The cable from the transformers on the east side of the lower level and the west side of the upper level is trench-lay cable, buried in the ground parallel to the tracks, and branches off at 80-ft. intervals under the tracks to receptacles in the same manner. The lower level was handled in the same way. Where possible, and the cable proved satisfactory, existing 4/0, 3-conductor trench-lay cable was used. Some of these lines were paralleled to get the necessary capacity. For the most part, the new cable installed is 3 single-conductor, 500 m.c.m. The remarkable part of this installation is that it was installed without interruption to train service.

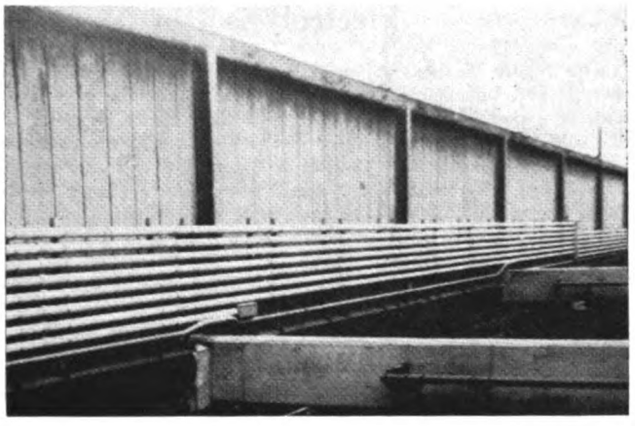


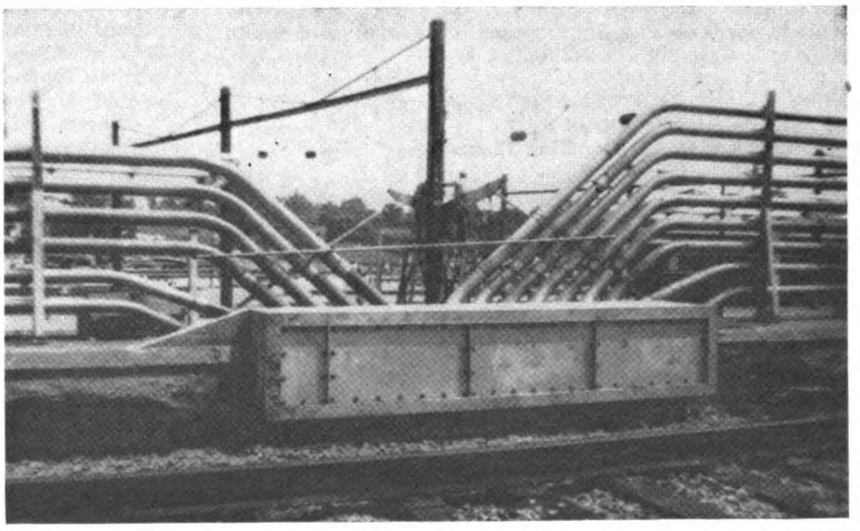
Fig. 4 (above)—Duct line along wall

Fig. 3 (right)—Transite duct line into transformer station

5. Power Supply for Standby Facilities For Air Conditioning

By S. D. Kutner

Mott Haven yard is the coach yard for the Grand Central Terminal. It is located 5.28 miles from the terminal and lies between 149th Street on the south, 161st Street on the north, Morris Avenue on the east, and Sheridan Avenue on the west, in the borough of the Bronx, in New York City. It has an area of 1,439,044 sq. ft., and is divided into 6 sections or yards. In addition, it has a car repair section.



These yards are designated by the following letters: A, F. J, B, W, M. Yard A has 5 short tracks and is used for storage of freight and milk cars destined for the local freight yards. Yard F has 11 tracks, and is used for the storage of cars and cut-outs. This yard has no platforms. Yards J, B and W have 18, 17 and 20 tracks, respectively, and are used for receiving and making up New York Central main-line trains. Yard M has 22 tracks and is used for making up New Haven main-line trains and some New York Central night trains. The car repair section has 7 short tracks. Only yards J, B, W and M are supplied with standby outlets.

The first major standby outlet installation for Mott Haven yard was designed in 1937 and provided 144 outlets in yards B and J, and 56 outlets in yard W. These outlets are all of the 60-amp. size.

The 1948 layout increased the number of outlets to the following totals, and in addition, provided service in yard M; 156 outlets in yards B and J, 71 outlets in yard W, and 96 in yard M. These outlets were all of the 100-amp. size.

The 1948 improvement program called for increasing all existing circuit breakers to 100-amp. capacity and wiring to minimize voltage drop as well as I^2R loss. Feeds were run at right angles to the tracks to diversify power loading of the main feeders. Four-wire, 3-phase, 60-cycle, 208-volt power is taken from the Consolidated Edison Company at the northeast and northwest ends of the yard.

At the northwest end of the yard, the service is split into two feeders, each rated 2,000 amp., and each of these is further reduced to two feeders, each of 1,000-amp. capacity. These, in turn, supply 350-kva., 3-phase, oil-cooled outdoor-type auto-transformers, which step the voltage up to 240 volts. The service from the auto-transformers is protected by main circuit breakers of 1,000-amp. capacity which serve the switchboard busses.

The switchboard busses are arranged in multiple, forming two groups, thus, permitting the greatest flexibility in the event of the failure of any component. The switchboard distribution breakers, 24 in number, up to 400-amp. capacity, serve branch circuit panelboards located at strategic points in the various yards, and here individual breakers of 100-amp. capacity serve each individual outlet.

At the northeast end of the yard, for mechanical reasons and because of space limitations, the 2,000-amp, service is split and serves two 350 kva., 3-phase, oil-cooled, outdoor-type auto-transformers which serve two main feeders direct to the branch circuit panels. Each branch circuit panel has main protection as well as protection for each individual outlet. Connections of panels to feeders are staggered to diversify further the feeder loading and make maximum use of the installed copper.

The entire installation was designed to minimize failures and to localize failures should they occur. Voltage drop was kept within economic limits, with 10 per cent permitted under maximum loading to the most remote point.

The new facilities can now handle 35-kw. cars without any difficulty, which was one of the major reasons for undertaking this project.

Credit for assistance in preparing this report is herewith given to Designer Otto T. C. Kettler.

6. Safe Practices in Diesel Fuel And Lubricating Oil Handling Plants

By J. W. Horine

Review of requirements has not developed any further information than that previously reported. Briefly, the rulings and regulations of local state or municipal authorities, insurance underwriters, railroad insurance departments or engineering offices govern where applicable. Where no such rulings or regulations exist, determination of class of motors and control must be based on such factors as whether the installation is outdoors (requiring weatherproof apparatus) or indoors. If indoors, factors such as ventilation, temperature of oil handled, presence of fumes, etc., must all be considered and that class of apparatus selected which will afford the maximum economic protection.

The committee recommends that this assignment be carried over another year. A questionnaire will be sent to member roads requesting information relating to various governing rules and regulations, and also the practices of the member roads.

The report was submitted by a committee of which C. P. Trueax, assistant electrical engineer, Illinois Central was chairman.

Discussion

C. A. Williamson (T. & N. O.) asked if any provision had been made to protect against moisture, where cables from wayside receptacles go into the ground. H. A. Hudson (Southern) replied that cables brought up into a box are sealed with compound. Mr. Williamson added that breathing will bring moisture into the receptacle housing and that it is necessary to have a drain plug to dispose of this moisture.

Referring to the Mott Haven installation, H. F. Finnemore (C.N.) asked if the 208 volts of the network were an actual or nominal values, and asked if 208 is sufficient for operation of standby motors. W. S. H. Hamilton (N. Y. C.) said the 208 volts had been boosted to 240.

Representatives of other railroads also confirmed the fact that 208 volts is insufficient, and one reported the use of booster transformers to raise the network voltage from 208 to 240.

Asked if a 100-amp circuit breaker is sufficient for a 35-kw. m.g. set on a car, S. B. Pennel 1 (N. Y. C.) said that the largest motor used on New York Central cars is 25 hp.

Following a discussion of the snap-out safety adapter for preventing damage to portable standby power cables when cars are moved before the cable is disconnected, Mr. Williamson endorsed the device as an excellent provision.

Electrolysis

The report of the Committee on Electrolysis is notable for a brief and sufficient summary of tests made by the committee over a period of years in which a positive direct potential of 25 volts was applied to steel electrodes encased in concrete cylinders of various diameters up to 25 in., and 6 ft. in length, buried in the ground. The ground was negative. Some specimens had no potential applied, and some an alternating potential of about 40 r.m.s. volts to obtain a current value comparable to the direct current.

Conclusions and recommendations made in the report are as follows:

The passage of direct current through imbedded steel into the concrete causes corrosion of the steel, with resultant formation of iron oxides with a volume expansion of several times. The resultant expansion produces cracking of the concrete.

Stainless steel has little effect in reducing the corrosion.

Alternating current alone does not cause corrosion.

Steel in concrete with no current flow is unaffected.

Direct current flow from concrete into earth containing sulfates attracts the negative sulfate ions to the concrete surface in large quantities and produces an accelated sulfate attack with resultant deterioration.

Alternating current does not deteriorate concrete.

Concrete with no current flow is unaffected.

The deterioration of steel and concrete is prevented by stopping the flow of current. This can be accomplished by insulation of the steel by coating it with an asphalt impregnated membrane. Other coatings may also be found suitable.

The deterioration of steel and concrete is prevented by stopping the flow of current. This can be accomplished by insulation of the steel by coating it with an asphalt impregnated membrane. Other coatings may also be found suitable.

No procedure or material is known that increases the electrical resistance of the concrete appreciably or prevents its deterioration. Concrete in damp ground is a relatively good conductor. Resistance to the flow of stray currents must come from other sources than the concrete.

The report was submitted by a committee of which H. P. Wright, assistant electrical engineer, Baltimore & Ohio, was chairman.

Overhead Transmission Line and Catenary Construction

During the past year, the Committee on Overhead Transmission Line and Catenary Construction has given consideration to correcting some minor discrepancies in the areas of grooved trolley wire. An accurate check of five sizes indicated a maximum error of 0.2 per cent which is considered satisfactory. It has also worked on the development of a gage for checking the size of grooves in trolley wires.

The major part of the report is a description of a long overhead power line crossing of the Susquehanna River, near Millersburg, Pa. This is as follows:

One of the longest river-crossing power-line spans in the United States was completed over the Susquehanna River, at the top of Berry Mountain Gorge, approximately one mile south of Millersburg, Pa. The crossing span, 5,367 ft. in length, was built for operation at 66 kv. Supporting structures on each side of the river are 670 ft. above river level, and the conductors sag to within 75 ft. of the river. This site was chosen because preliminary engineering established that the entire gorge could be spanned, and thus eliminate costly construction and the hazardous location of towers on islands. Many engineering problems entered into the design of this line, namely: Types of supporting structures; type of conductors; spacing of conductors; lightning protection; and the meeting of all requirements of the Public Service Commission and the National Electrical Safety Code.

The crossing span is supported by a three-mast steel structure at each end, one conductor being attached to each mast. The masts are 14-in. wide-flange H-sections, weighing 87 lb. per ft. They are spaced on 30-ft. centers and are guyed to provide necessary longitudinal and lateral strength-requirements. Each mast is imbedded in a concrete foundation 3 ft. square, and 5½ ft. deep, to spread the downward thrust over a larger area. The masts are designed on the basis of 18,000 lb. per sq. in.,—60 L/R in compression, and 18.000 lb. per sq. in. in tension, the maximum L/R ratio being 140 on the longest mast. Each structure is supported by thirteen 21/32 in., 19-strand EHS Copperweld anchor guys, and one similar inter-mast guy, each having an ultimate strength of 37,690 lb. Two anchor guys on each mast provide the required longitudinal strength for the long span. Two side guys in each direction provide the lateral strength. Three additional guys in the direction of the long span, one on each mast, support all dead end loads in the adjacent spans.

The guys are attached to steel anchors fabricated from 8-in. channels 8 ft. long, held together with tie plates and buried 7 ft. is concrete. Guy wire ends are equipped with compression-type clevis to assure developing full strength, without slippage. The conductors used were a special Copperweld composite of 19 strands, 4 being of hard-drawn copper, and 15 of 30 per cent Copperweld steel. The conductor attachments are double-string tension assemblies using 25,000-lb. ball-and-socket type, 10 in. disc insulators, 8 units in series in each string. The two outside conductors were installed to a sag of 590 ft., and the middle conductor 560 ft., at 60 deg. F., no ice or wind load. This conductor separation at the center of the span affords an additional safeguard against swing. The center conductor is stressed to 50 per cent and the two outside conductors to 48 per cent of ultimate strength when loaded with ½-in. ice and 8-lb. wind.

Because of the high cost of erecting overhead ground wires, expulsion gaps were installed on each of the supporting and adjacent structures to drain off lightning charges. On the remainder of the line, two-pole "H" structures support the power conductors. Two overhead ground wires and a buried counterpoise provide lightning protection. In order not to interfere with traffic over two important highways and the Pennsylvania Railroad, temporary wood poles were installed close to both sides of the river. Two portable radio sets were used to provide communication between opposite sides of the river, which materially aided operations. A ½-in. hemp rope was first strung across the river. This, in turn, was replaced by a 7/16-in. plow steel cable, since the rope was not considered strong enough to pull the conductors across the gorge. Finally, the three Copperweld conductors were fastened to the steel cable and were pulled from the east shore to the west shore of the river by means of a winch-equipped line truck. Men in boats on the river were constantly on the alert to prevent the conductors from becoming snagged in the rocky river bottom. The entire wire-stringing operation, including pulling the conductors to final sag, required only four days.

The report was submitted by a committe of which E. M. Hastings, Jr., wire crossing engineer, Chesapeake & Ohio, was chairman.

Discussion

In response to a question, L. B. Curtis, (P.R.R.) said that 12 electrified railroads had been asked about a gage and several had replied that they had no use for such a gage, since they only use one size of wire and that the gage is used to check wire before it is delivered by the manufacturer. H. F. Brown (N.Y., N.H. & H.) said it would appear that a go- and no-go gage, such as that being considered, could be used only at the ends of the wire and that no one liked to cut the wire unnecessarily. He expressed the opinion that some kind of measurement should be used.

Mr. Curtis replied that the committee had investigated a gage which could be used anywhere on the wire but had found it to be impracticable to make such a precision gage without running the cost too high. K. H. Gordon (P.R.R.) said he considered a gage used at the end of the wire to be adequate since the clips are not highly accurate in size and the wire should be sufficiently similar throughout its length. Mr. Brown suggested that the railroads use the manufacturers' gages, and Mr. Curtis replied that some inspectors are not satisfied with this procedure.

Corrosion Resisting Materials

The Committee on the Application of Corrosion-Resisting Materials to Railway Electrical Construction has been on a standby basis during the past year and presented only a token report. Over a period of years, it has developed a large amount of valuable data on corrosion of metals exposed to steam locomotive exhaust gasses and salt spray. In reporting for the committee Chairman H. F. Brown said an endeavor will be made in 1951-1952 to start an investigation to determine the relative corrosive effect of diesel exhaust as compared with steam locomotive exhaust on overhead structures.

The report was submitted by a committee of which H. F. Brown, electrical engineer, New York, New Haven & Hartford, is chairman.

Protective Devices and Safety Rules

During the past year, a number of tests have been made by the Committee on Protective Devices and Safety Rules to determine some yardstick whereby resistance between tank car bodies and rails might be predetermined with the idea that some changes in the existing manual material might be desirable. To date, tests have not been conclusive and the committee has not been successful in developing sufficient information to warrant any change in existing instructions.

The report is signed by J. M. Trissal (*chairman*), assistant chief engineer, Illinois Central; S. W. Law (*vice-chairman*), signal engineer, Northern Pacific; D. M. Burckett, electrical engineer, Boston & Maine; F. J. Corporon, superintendent way and structures, Chicago, South Shore & South Bend; H. F. Finnemore, chief electrical engineer, Canadian National; S. M. Viele, assistant engineer, Pennsylvania; and R. P. Winton, testing engineer maintenance of way, Norfolk & Western.

Discussion

H. F. Brown (N.Y. N.H. & H.) asked if any electrified road had had experience with rails of a siding connected to ground near a building so that sparks might be caused by contact between the building and a car on the siding. Although no flammable materials were involved, to avoid sparking it was found necessary to isolate the siding from the main line and connect the siding rail to the building. Mr. Trissal cited similar experiences.

Electric Heating

The report of the Committee on Electric Heating covers detailed specifications for tubular type electric heaters for track switches, and these specifications were submitted by the committee for adoption to replace specifications of the same type now appearing in the Electrical Section manuel. The report also includes tables covering Pennsylvania track switch heater installations in both a.c. and d.c. territory.

The final section of the report describes film type electric heaters consisting of thermosetting electrically-conductive plastic material, first used for aircraft anti-icing applications. The heating elements can be used at temperatures up to 400 deg. F. with power input as high as 30 watts per sq. in. Applications of possible interest to railroads are oil transfer and hydraulic systems, oil storage, fluid heaters, food containers, heaters for air intakes of limited volume, railway car heating and other space heaters.

The report was submitted by a committee of which C. A. Williamson, electrical engineer, Texas & New Orleans is chairman.

Discussion

The report was presented by Chairman C. A. Williamson who called on E. B. Hager (I.C.) to present the section of the report on track switch heater specifications. Mr. Hager reported that the application of heaters was not as simple a subject as might appear. Clamping to the rail, he said, was of most importance because, if the clamps are not drawn up, the heating element will work loose, and if clamped too tight, the element will buckle. He recommended tight clamping at the center, and looser clamping at the ends, to allow for expansion. Concerning wattage, Mr. Hager said railroads express preferences for different ranges running from 275 to 500 watts per foot. The latter, he said, seems ample for the most extreme conditions in the United States.

The section of the report covering the Pennsylvania installations was presented by L. B. Curtis (P.R.R.). He said plans had been made to make tests with heavy snow and wind.

Chairman Williamson presented the section of the report on film type heaters. W. S. H. Hamilton suggested that the report should include the type of conducting glass used for operators windows on New York Central m. u. cars. Mr. Williamson said this had been touched upon in the 1950 report, and that if desirable, further information would be included in next year's report.

Communication Systems on Rolling Stock

The report of the Committee on Application of Radio and Communication Systems to Rolling Stock states that trouble has been experienced with the present communication train line jumper, especially on trains operating through low temperatures. During the past year, representatives of the committee held four meetings with manufacturers' representatives and prepared a revision of the jumper specifications.

This re-written requirement specification contemplates that a change in the insulation of the jumper cable pairs—possible to pure rubber—plus the use of an outer cover of material which would retain flexibility at a temperature of minus 40 deg. C., would provide the required flexibility at the expense of some increase in the effective capacity between cable pairs. Accordingly, the proposed specification increases the allowable capacity from 30 to 50 micro-micro farads per foot. Further revisions permit the use of a jumper cable consisting of five shielded pairs, two No. 12 and one No. 16 single-conductors non-shielded in lieu of seven shielded pairs as now required. Other additions and deletions were made to simplify the wording of the specifications.

Another work assignment to the committee was to recommend housing dimensions for radio transmitting and receiving apparatus for mounting in any location on the exterior of locomotives, water tenders, cabooses or cabin cars. The recommendation states that such housings shall be made of corrosion-resistant metal or steel which has been given a corrosion-resistant treatment inside and out. Dimensions recommended are, width—31.5 in., height—14.5 in., and depth—21.5 in., with a cover on the 31.5-in. by 14.5-in. side.

Concerning power supply the report reads as follows:

Since standard transmitting and receiving apparatus on rolling stock requires single-phase, 50-70 cycle, 105-129 volts r.m.s. power supply and since the primary source of power on rolling stock is predominately direct current, the problem of securing and maintaining a reliable and economical conversion unit has proven to be a major problem.

Early installations for alternating current radio equipment were made either with single phase power generated by internal combustion engine, steam and air turbine-driven alternators or direct current systems with motor generator sets provided to convert the battery voltage to the above mentioned a.c. voltage.

Comparative maintenance costs and reliability over the many operating conditions involved have resulted in the d.c. primary source of power with a.c. conversion equipment, being used almost universally.

Early in 1947, a vibrator (inverter unit) was developed which provided regulated sine-wave output. Later, refinements were made to this unit wherein, plug in, dual vibrator circuits were employed and a very satisfactory vibrator type converter is now available. While it is apparent that maintenance costs vary slightly from one railroad to another, general indications are that approximately 50 per cent savings can be made on both in initial cost and maintenance, using this type of inverter in place of others.

Normal life of the vibrator in service on switch engines has been between 60 and 90 days on a 24-hr., 7-day per week basis, while vibrator service life in diesel road locomotives is from 90 to 120 days, caboose service being over 6 months, life in each case being dependent on actual length of time vibrators are in service.

The big advantage in this inverter is that service is never completely lost if maintenance personnel replaces the defective vibrator after the automatic switch-over has been made, the interruption to the radio service is a matter of approximately one to two minutes for each vibrator failure.

It is not the committee's intent that this report be final on this assignment, but after discussion in the annual meeting and another year of development has been made, that a conclusive report can be submitted.

The report was presented by a committee of which W. S. Heath, electrical assistant, Atchison, Topeka & Santa Fe, is chairman.

Discussion

W. S. H. Hamilton (N.Y.C.) said that the committee's recommendations on power supply apparently contemplate conversion of all power to a.c. before it goes to the radio. The use of 12- and 14-volt d.c. power, he said, should be given full consideration for caboose power since, when it is used, filaments are fed from low-voltage d.c. power and only about half of the power needs to be converted to a.c. Committee Chairman W. S. Heath (A. T. & S. F.) replied that railroad men are evidently becoming cognizant of the advantages of 12-volt d.c. power. Mr. Hamilton then said his railroad has such equipment under development, and that he will report on it next year.

Electrical Repair Shops

The report of the Joint Committee on Electrical Facilities and Practices for Repair Shops was presented by C. F. Steinbrink, electrical foreman, Chicago, Rock Island & Pacific.

Previous committee reports gave information on apparatus required in motor shops and a sub-committee is now developing information on how this apparatus is used with view of making definite recommendations on such use. The present practices of the larger electrical manufacturing and repair companies and of railroads which are extensively engaged in this type of work are being developed for review and comparison.

The following specific questions are being investigated:

1. What methods and practices are followed for mechanical repairs of end bells, motor support bearings, motor support bearing housings, armature bearings, shafts, etc.?

2. What methods and practices are followed for electrical repairs to traction motors and main generators in connection with windings and commutators?



L. C. Bowes

Electrical Section—Mechanical Division Association of American Railroads

Officers

L. C. Bowes, *Chairman*, electrical engineer, Chicago, Rock Island & Pacific, Chicago

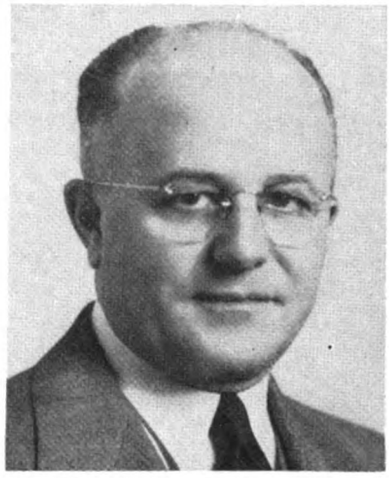
H. C. Paige, *First Vice Chairman*, assistant mechanical engineer, New York, New Haven & Hartford, New Haven, Conn.

R. I. Fort, *Second Vice Chairman*, assistant research engineer, Illinois Central, Chicago

Fred Peronto, *Secretary*, Electrical Section, Mechanical Division, A. A. R., Chicago



H. C. Paige



Fred Peronto



R. I. Fort

In view of the large field covered by the above subjects, in connection with the various types of motors and generators involved, the study is not yet completed and is continuing.

The routine testing of traction motors having been covered in previous reports, this investigation is being largely confined to practices on testing stacked armature laminations. The practices of the same companies mentioned under assignment 3 are being developed, information obtained so far indicating a wide variation in practice from no testing to rather complete testing.

The following specific questions are being investigated:

1. What tests are made with what test apparatus on traction motors and generators?

2. What means, if any, is used to check the quality and insulation of the laminations on armatures?

Replies are being received but are not yet complete, and study is being continued.

The report is signed by a Joint Committee of which J. W. Horine, general superintendent motive power—diesel, Pennsylvania, is chairman.

Discussion

Mr. Steinbrink (C., R. I. & P.) said he had asked questions of a number of roads, but that replies had been received too late for inclusion in the report. He recommended that more active men be added to the membership of the committee. L. C. Bowes (C., R. I. & P.) asked for more members for the committee, and suggested that questions to railroads be sent out earlier.

Wiring Diagrams for Rolling Stock

The report of the Committee on Wiring Diagrams for Rolling Stock consists of revisions of much of the data previously recommended and published in the Electrical Section Manual. It includes an illustrative diagram, sample, schematic, connection and construction diagrams, many diagrams showing schematic wiring symbols, recommendations for lead and terminal markings with illustrative diagrams and tables of identification letters for wiring diagrams.

The report is signed by a committee of which E. J. Feasey, general supervisor diesel equipment, Canadian National, is chairman.

Discussion

In presenting the report, Chairman Feasey said the committee

had found it necessary to completely revise material in the manual, and to include some omissions. S. B. Pennell (N.Y.C.) suggested that this would be a good time, if there were any disagreements between manufacturers and railroads, to have proposed changes submitted to both. W. S. H. Hamilton (N.Y.C.) asked if most manufacturers had not agreed to adopt specifications if they were adopted by the Association of American Railroads. R. I. Fort (I. C.) said that the members of the A. A. R. can do much toward setting up a set of standards and added that when such standards had been proposed to the manufacturers, they had been most cooperative. Mr. Hamilton said he thought the Electrical Sections should go on record in extending a special vote of thanks for the work which has been done by this committee.

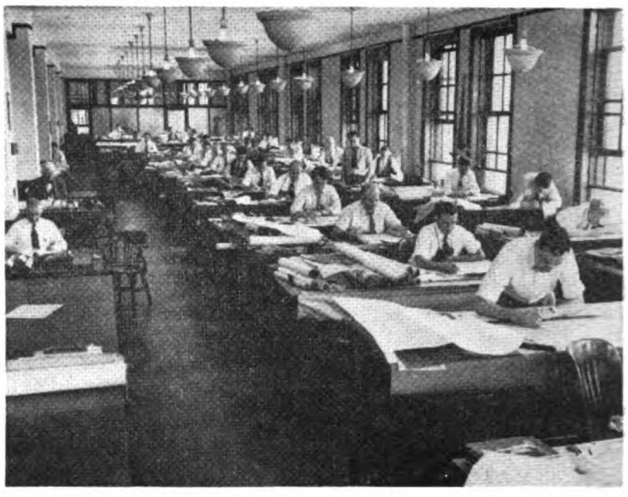


Fig. 1—Main drafting room, engineering department, general offices, Baltimore & Ohio, Baltimore, Md., before the bowl-type lighting fixtures, with incandescent lamps, were replaced

Illumination

Since the report of the Committee on Illumination was compiled Chairman E. R. Ale has retired from railroad service, and the report was presented by L. S. Billau, electrical engineer, Baltimore & Ohio. The first section of the report consists of a comparative cost analysis of lighting systems employing respectively 85-watt fluorescent lamps in 4-lamp reflectors, 400-watt, high intensity



Fig. 2—The engineering department drafting room after the installation of continuous rows of semi-indirect fluorescent lighting fixtures

mercury vapor lamps, and 1,000-watt incandescent lamps. All have a 25-ft. mounting height. All costs including installation, energy costs, lamp replacements, cleaning, etc., are included. For equal illumination, with power at one cent per kw.-hr., the analysis shows that the total annual costs of the mercury vapor lighting is 3 per cent more than fluorescent, and incandescent lighting cost is 18 per cent more than fluorescent, when lights are burned 2,500 hours per year. With higher power costs, the difference between the fluorescent and mercury lighting remains the same but the relative cost of the incandescent system increases. Longer burning hours are a further disadvantage to the incandescent system.

The latter part of the report consists of examples of good lighting in a drafting room and a railroad passenger terminal. It is reproduced here in full.

Drafting Room

The illumination of drafting rooms has always presented a difficult lighting problem as the requirements call for very high intensities of illumination without glare and with practically no shadows on the drafting tables. Totally indirect as well as semi-indirect lighting systems, using filament lamps, have been largely standard for this class of work, but as fluorescent lighting came into general use it was soon found that the illumination produced by direct lighting units was unsatisfactory and that units either of the diffusing type or semi-indirect type were necessary.

After studying different types of drafting room lighting systems, the Baltimore and Ohio has just completed the installation of a modern fluorescent lighting installation in the engineering department's main drafting room in its general office building in Baltimore. The size of this room is 136 ft. by 22 ft. The original lighting installation consisted of totally indirect lighting fixtures of the bowl type using incandescent lamps, which has been replaced with continuous rows of semi-indirect fluorescent lighting fixtures. The results obtained have been very satisfactory, uniform intensity of illumination being produced without objectionable glare and the elimination of shadows on the drafting tables. The following



Fig. 3 — General view of the main waiting room, Reading Terminal passenger station, Philadelphia, Pa.

furnishes some of the detail information covering the old and new lighting systems:

	Original Lighting	Improved Lighting
Room dimensions	22 ft. wide by 136 ft. long	22 ft. wide by 136 ft. long
Ceiling height	11 ft. 3 in.	11 ft. 7 in.
Fixture mounting	Chain suspended — 30 in. from ceiling	Stem suspension—23 in. from ceiling
Ceiling finish	Plaster, painted white	Acoustic tile—white
Type of lighting fixture	Incandescent, indirect	Fluorescent, semi-indirect
Number of fixtures	32	108
Type of lamp	300—500 watt I.F.	F 85 T-17/W
Number of lamps	16—300 watt, 16—500 watt	216
Fixture spacing	9 ft. 3 in. by 8 ft. 6 in.	Continuous rows, 5 ft. 3 in. C/L
Watts per sq. ft.	4.35	7.3 including losses
Average illumination	15 foot-candles	85 foot-candles, maintained

Figure 1 shows the original type of lighting system and Fig. 2 the new fluorescent lighting system. Conditions were such that it was necessary to take both photographs during daylight hours, with the consequence that the full effect of the artificial illumination is not shown.

Passenger Station

There has been considerable activity on the part of the railroads in modernizing many of the older larger terminal passenger stations throughout the country. A recent outstanding example is the Reading Company's terminal passenger station at Philadelphia. This terminal has recently undergone extensive alterations, including complete modernization of the waiting room, ticket office and train concourse, as well as the alteration of other station facilities. Fluorescent lighting was adopted for a large part of the terminal building. The lighting is of particular interest in that the design, type and arrangement of the lighting system were carefully worked out to fit in with the general architectural treatment of the building interior, resulting in not only providing much higher intensities of illumination but also very pleasing effects.

Briefly the lighting equipment and its arrangement consist of the following:

Three-tube, 40-watt fluorescent recessed troffer-type fixtures with



Fig. 4 — General view of the concourse, Reading Terminal passenger station, Philadelphia, Pa.



Fig. 5 — The new ticket office, Reading Terminal passenger station, Philadelphia, Pa.

controllers. Wiring is arranged so that the center tube is controlled on one circuit and the two outside tubes on another circuit. This permits a variation in the amount of light in the room since one, two or three tubes in each row of fixtures may be lighted at any time. There are six rows, each consisting of nineteen 48 in. fixtures on 20 ft. spacing, mounted 16½ ft. above the floor. The average maintained illumination is approximately 20 foot-candles. Figure 3 is a general view of the main waiting room.

Concourse

Three-tube, 40-watt recessed troffer fluorescent-type fixtures with controlens. Fixtures are hung from the ceiling by means of supporting rods approximately 6 ft. long. The ceiling above the fixtures is painted black for contrasting effect, and fixtures are at same height and in line with those in the waiting room to give the effect of continuous rows. Average maintained illumination in this area is approximately 15 foot-candles. Figure 4 is a general view of the concourse.

Ticket Office

All lighting is fluorescent type. In addition to the general overhead lighting in the waiting room, which also illuminates the ticket office, there are additional fluorescent lights over the ticket counter. This lighting consists of two rows of single-tube fluorescent strip lighting with 15-watt and 20-watt tubes mounted in the ticket counter light trough. Figure 5 shows the new ticket office and the effect of the lighting arrangement used.

Lighting in the men's room consists of 8-ft. and 6-ft. slimline fixtures on 18-in. suspensions, and with two exposed tubes per fixture mounted so as to form a continuous row around the sides of the room.

In the women's room, three-tube fixtures, similar to those used in the waiting room, are mounted in the accoustical ceiling.

Pendant-type industrial fluorescent lighting units, single or continuous, as required, and having two 40-watt tubes per unit, are installed in the parcel check rooms.

Under the marquees and in the lobby, there are two-tube, 40-watt recessed troffer-type with flat glass covers. Lamps are instant-start type.

Over moving stairways, there are two-tube, 40-watt, 30-watt and 20-watt fluorescent-type units.

The report was presented by a committee of which L. S. Billau, electrical engineer, Baltimore & Ohio, is chairman, succeeding E. R. Ale, retired.

During a brief discussion which followed the report, L. C. Bowes (C., R. I. & P.) called attention to a recently developed high-intensity, mercury vapor lamp with a red phosphor coating which removes the need for mixing incandescent lighting with mercury to obtain a good color of light.

Welding and Cutting

The report of the Joint Committee on Welding and Cutting deals entirely with welding on diesel locomotives. This was done because the diesel presents new problems to the welder.

Aluminum Pistons

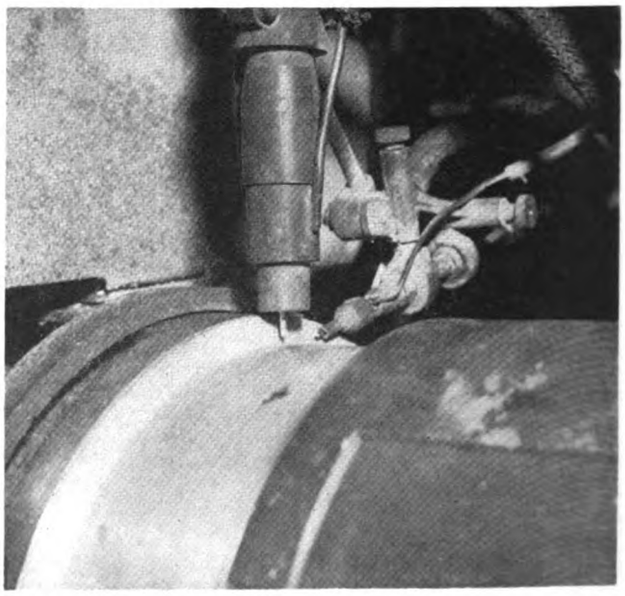
The report states that the inert, shielded arc is preferable for welding aluminum pistons. It describes the process and its application to the welding of pistons and offers the following conclusions:

It should not be taken for granted that the consumable electrode process is always superior to the tungsten arc method. In those shops where only a small number of pistons are to be reclaimed, the elaborate and most costly equipment for inert-gas shielded consumable electrode welding will not be justified as long as one man can keep up with the work with the tungsten arc process.

The inert-gas shielded consumable electrode process has proved itself highly satisfactory for diesel piston reclamation on the following points:

(a) It offers excellent economy.

(b) It yields deposits of entirely satisfactory quality.



Main and auxiliary feed wire for welding aluminum piston

(c) Operation is neither difficult nor critical.
(d) It is flexible.
Equipment required and procedures are illustrated.

Reclaiming Cylinder Heads

Cast iron cylinder heads, the report states, may be repaired at a fraction of the purchase price and have been found to be equal in every respect to new ones, when proper welding procedures and control are used and parts are machined accurately to original tolerance. The report further states that because of its versatility, oxy-acetylene welding is widely used for this work. Inert arc gas welding is also recommended in the report as being more economical because it does not involve the removal of slag. Procedures for welding heads are described and illustrated in the report.

Means for reclamation of engine valves, the welding of engine A frames, including liner seats, are also described and illustrated.

The report is signed by a committee of which L. E. Grant, Engineer of tests, Chicago, Milwaukee, St. Paul & Pacific, is chairman.

Discussion

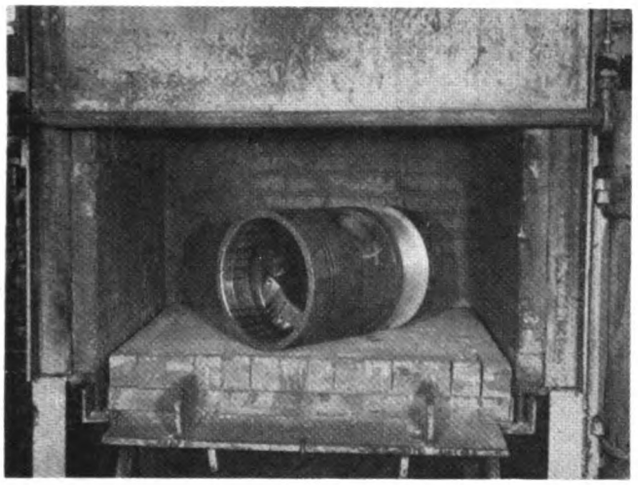
In presenting the report, Chairman L. E. Grant explained that care in following procedure accurately was highly important since parts can be damaged by improper welding, by movement of parts during welding, etc.

H. C. Paige (N. Y., N. H. & H.) asked for the cost of reclaiming pistons by welding, wanting to know if it were, for example, one-half or one-third the cost of a new piston. Mr. Grant replied that it runs from one-half to one-sixth, the lower figure being obtained by the use of an automatic welding head.

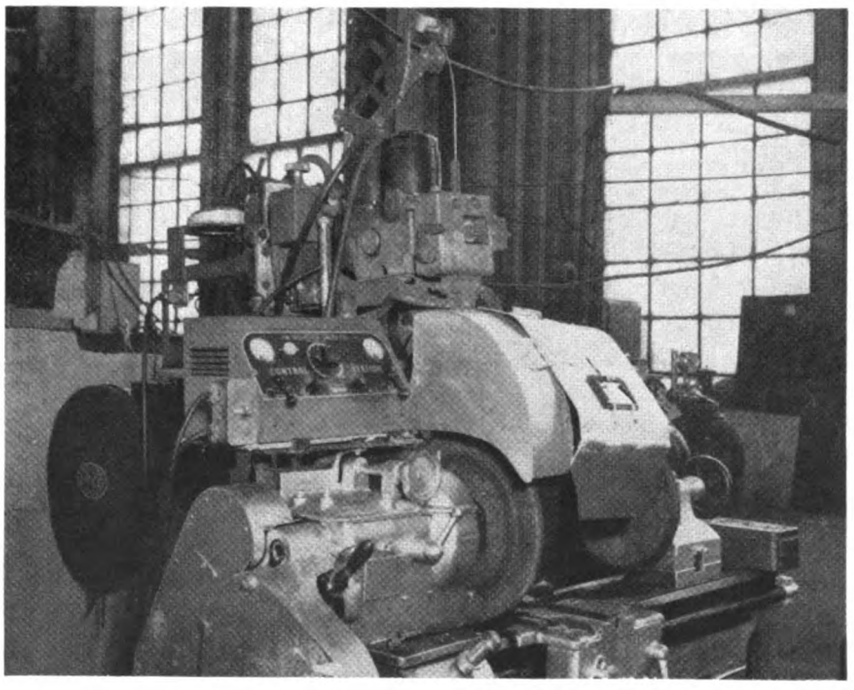
Concerning the welding of cast iron piston heads, Mr. Paige said that its success requires very slow cooling—New Haven practice being to put the piston heads in a box full of asbestos and allow them to cool for two days.



Aluminum diesel piston prepared for welding



Above: Preheating diesel piston for welding



Right: Automatic machine for inert-arc welding



Manual gun for inert-arc welding

Car Electrical Equipment

In response to its first assignment, namely, to continue the study of diesel engine-driven generator sets for individual passenger car power supply, the Committee on Car Electrical Equipment reports that about 125 such units are now in service and that there are 130 on order. No serious trouble has been experienced in their operation and the use of d.c. systems has been extended with highly satisfactory results. Concerning one specific installation, the committee reports as follows:

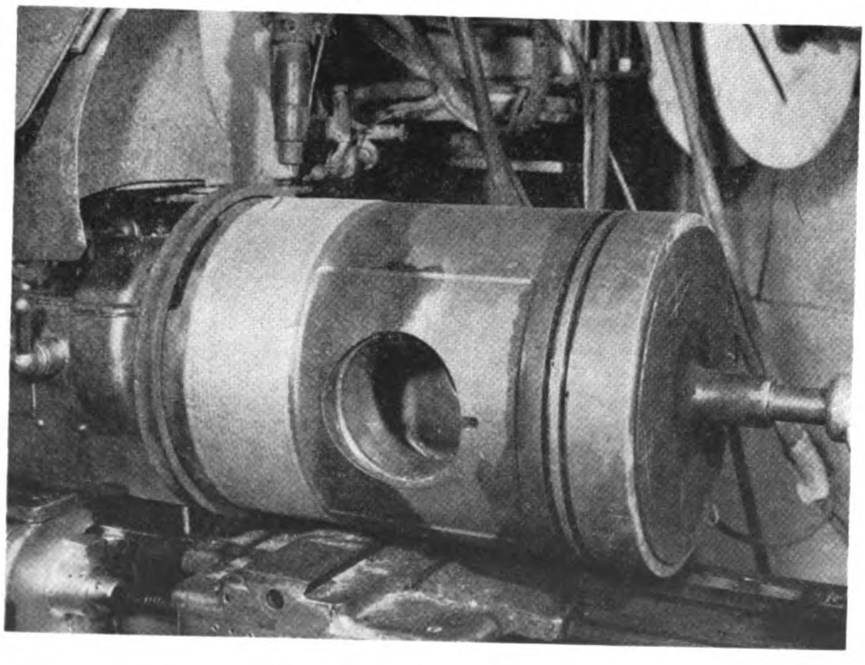
1. Increased capacity. The original units had a total capacity of 45 kw. with a total connected load of 60 kw. The new units will have a combined capacity of 60 kw. which is more in line with the total connected load.

2. Paralleling the two power plants. Parallel operation will reduce the complexity of control and switching circuits and provide greater availability of all appliances in case of partial outage.

3. Piping engine exhaust through the roof. The old method was to allow engines to exhaust under the car. At times, with a slightly smoky exhaust, adverse comments were made while the car was standing in the train shed before departure.

The results obtained from the above changes will be available for future committee report.

A major part of the report is concerned with proposed revisions of the Electrical Section Manual. The items covered include general specifications, generators, car-body terminal blocks, axle pulleys and bushings, generator regulators, reverse current relays, load-voltage regulators, inspection, shipment guarantee, etc., the a.c. end of motor-generators, axle-generator mountings and suspensions, clearances, steam and water drips, pulley axles and wiring. Concerning communication circuit jumpers, it is recommended that a completed jumper between cars should be 60 in. long overall. From information obtained by a questionnaire, it was learned that a majority of member roads recommend the use of six-point receptacles with a latch automatically released with a heavy pull.



Aluminum piston welded in a jig on automatic welding head

A preliminary study of trainlining of cars including capacity of switches, circuit breakers, coupler sockets, jumpers, etc., for 30-60- and 110-volt d.c. and 220-volt a.c., three-phase circuits, disclosed a rather sharp difference of opinion as to the trainline requirements and maximum loads that are to be carried on a standard trainline. Accordingly, the committee has prepared a questionnaire which will be used to correlate information on this subject.

Included in the report are four drawings showing four ways, used by different roads to protect overhead jumpers between cars with special reference to the protection of passengers heads. The committee recommends that this subject be referred to the Committee on Passenger Car Specifications, Mechanical Division, A.A.R., for consideration in the design of future passenger equipment.

The Electrical Section was requested by the A.A.R. Committee on Prices for Labor and Materials to develop a formula for how to charge a car owner for charging batteries of cars equipped with a.c.-d.c. conversion equipment when such cars are in Interchange or line service. The power used for this purpose is 220-volt, 3-phase, a.c. power.

In response to this request the Committee on Car Electrical Equipment has made the following recommendation:

It would appear that the following basic formula would apply and could be used in preparing bills for this service:

$$\text{Kw.-Hr.} = \frac{\text{Line Ampere x phase voltage x 1.73 x P.F. x hours}}{1000}$$

In practice, however, a number of difficulties arise. The 220-volt, three-phase stand-by facilities are generally not arranged for centralized metering of energy to individual cars. The average value of current to be used is not readily obtainable and it varies with the capacity of the battery, the initial state of charge, the time of charge and the condition of the battery. The average power factor is not readily determined. There is a tendency to leave the battery on charge longer than necessary when turn-around time will permit. These factors make an equitable application of this formula to individual cars difficult, if not impossible.

In view of this situation the committee decided to attempt to set up a cost on the basis of a flat rate per car.

The committee had available statistical data on 1981 cars charged for one railroad during a 13-month period at a large eastern terminal. This data showed that a number of batteries were placed on charge unnecessarily and many were left on charge longer than necessary. It, also, showed the state of charge of the batteries on arrival at the terminal. The committee also had available test data from which the average efficiency of the a.c.-d.c. conversion apparatus could be determined. This test data has been analyzed with the following results:

Weighted average specific gravity on arrival	1.172
Weighted average time on charge	7 hrs. 39 mins.
Weighted average per cent of full charge	56.7
Average efficiency of motor generator	56.7

During the average time available the average battery will be brought approximately to full charge. It is assumed 40 per cent of capacity will be added.

The cost of energy is based on a figure of 11 cents per kw.-hr., same as used by the Price Committee for d.c. energy. This cost was developed from tests made in 1935 and rechecked in 1947.

By using the statistics on the 1981 batteries and the test results, an average value for kw.-hr. furnished and corresponding costs can be derived as follows:

Most of the batteries concerned were 600-amp.-hr. capacity 64-volt. The energy capacity of the battery is, therefore, 64 x 600/-1000=38.4 kw.-hr.

40 per cent of this capacity is 15.36 kw.-hr.
Assume battery efficiency of 75 per cent
D.c. energy to battery is 15.36/.75=20.48 kw.-hr.
Average efficiency of m.g. set is 56.7 per cent
A.c. energy to m.g. set is 20.48/.567=36.1 kw.-hr.
Add service factor of 15 per cent = 5.4 kw.-hr.

Total kw.-hr.=41.5 kw.-hr.
Cost at 11 cents per kw.-hr.—$4.56.

Many batteries of smaller capacity as well as larger capacity are in use. The larger batteries would take more energy during the charging period. However, the only difference in cost would be for the alternating current energy, as maintenance, labor and fixed costs would be the same. Inasmuch as the rate of 11 cents per kw.-hr. is somewhat arbitrary and probably high for alternating current energy, it is recommended that no distinction be made between the various sizes of batteries.

As this assignment required immediate attention, the cost as determined by the subcommittee was reviewed and unanimously approved by all members of the committee.

Pending completion of additional tests and further detailed study still in progress, the following recommendation was submitted to the Committee on Prices for Labor and Materials:

"Electric current for charging storage batteries on cars equipped with a.c. motor driven conversion apparatus from 220-volt, three-phase, 60-cycle, facilities, including labor, per car charged—$4.60.

"Note: This charge applies irrespective of length of time car is on charge or number of cars on same a.c. charging line and does not include cost of precooling. Billing repair cards need only show 220-volt alternating current charging of batteries."

This recommendation was unanimously approved by the Price Committee on March 22, 1951.

The report is signed by a Committee of which S. B. Pennell, assistant engineer, New York Central, is chairman.

Discussion

Chairman Pennell, in presenting the report, said the committee had received reports of a considerable number of armature shaft failures, but had not had time to investigate these conditions. The present specification M 104 B calls for a steel having a maximum tensile strength of 90,000 lb. with a yield point of 60,000 lb. Consideration is being given to using M 127 steel, having a maximum tensile strength of 105,000 lb. and a yield point of 80,000 lb.

G. W. Wall (D. L. & W.) said he had been asked about the omission in the report of the designation "lamp regulator." He said that in the specification it had been termed "load regulator," since it really performs more functions than regulating lamp voltage.

Mr. Pennell said that there had always been much disagreement on what train lines should consist of and urged the members to give the subject careful thought when they receive the committee's questionnaire. He also said he thought that car builders should give special attention to jumpers between cars to permit interchangeability. L. F. Reynolds (The Budd Company) replied that the manufacturers are now working to reach an agreement on this subject.

Asked if the cost of 11 cents per kw.-hr. for battery charging power were not high, K. H. Gordon (Pennsylvania) said that while it is apparently high, it is really not the cost of power alone, but that labor and facilities represent a major part of the cost. Relatively, he said, the actual cost of power is "peanuts."

Car Air Conditioning

Concerning the air conditioning of dining car kitchens, the report of the Committee on Car Air Conditioning equipment has the following to offer:

Ventilation of dining car kitchens has always been a problem that is difficult to handle. One railroad has attacked the problem by using the following design criteria:

1. All kitchen windows and doors to remain closed.
2. Air flow between the diner section and the kitchen to be toward the kitchen to prevent odors entering the diner.
3. Air movement should exist in all areas of the kitchen.
4. Air velocity should be low enough to avoid drafts on the crew.
5. Air velocities should be high enough to permit the crew to feel air movement.
6. Air temperature throughout the kitchen, from floor to head level, should be as nearly equal as possible.

7. Sufficient air changes should be provided to insure maximum transfer of heat to the intake air.
8. Radiant heat protection should be provided for the crew.
9. Increased cleanliness in kitchen and diner by filtering of the air.
10. Provide air velocity across the range to pull heat, smoke, and cooking fumes away from the crew.
11. Elimination of grease from exhaust ducts to eliminate fire hazard.

Two distinctive types of temperature problems exist in the kitchen: radiant heat and convective heat. The first is handled by mechanical means, such as radiant shields, and the second by the transfer of heat to the inlet air.

Radiant Heat

Radiant heat protection was obtained by placing a shiny metal surface between the source of heat and the area to be protected. This reflective surface directs the radiant energy back towards its source. In modern stainless steel kitchens, radiant heat can become particularly severe, since once it enters the open area, it will reflect back and forth between the stainless steel surfaces and build up high temperatures. In the application on the road referred to, radiation shields consisting of stainless steel sheets with asbestos liners were installed over all doors on the front of the range, in front of the dishwasher, and around the vent stacks for the fire boxes.

Convective Heat

Pressurization of the car must be accomplished with fresh air from the diner system only, to prevent kitchen odors in the dining room. Therefore, the fresh air taken into the kitchen and exhausted from the kitchen was balanced so that the volume of inlet air is equal to the exhaust fan volume plus the air leakage through floor drains, broiler vent, fire box vent, and other exit points. This balance is important to maintain the proper flow direction, and to avoid excessive amounts of fresh air from the diner system for the purpose of pressurization. Temperatures that were obtained at various locations in the kitchen were dependent somewhat on outside temperatures.

The difference between ventilating and cooling should be recognized in evaluating any system. Good ventilation is accomplished by introducing a sufficient number of air changes per minute and distribution of air to all areas of the kitchen. Such a system will provide maximum results obtainable by ventilation.

In this system, a fan draws fresh air through a hooded inlet on the side of the car; it passes through filters and finned radiator heating coil, and is thermostatically controlled for tempering the outside air during the heating season. Below the hood, covering the fresh air inlet, an air scoop, having a width of 3⅜ in., is installed to assure air being delivered in the kitchen at all train speeds. The scoop is placed 2¾ in. below the center of the hood, and it is angled down from the center of the scoop at a 5 deg. angle in both directions, so as to scoop air into the hood regardless of whether the kitchen end of the car is run forward or to the rear of the train. There is an inlet grille in the hallway opposite the kitchen, which feeds cooled air from the dining room into the duct, where it is mixed with the outside air before it enters the kitchen. A rectangular duct, measuring about 14½ in. by 15½ in., extends along the center of the kitchen about 3 in. from the ceiling for a distance of about 9 ft. The end of this duct is sloped back at the bottom 20 in., so as to provide a larger area of distribution. About 33 in. from the end of the kitchen where the duct enters, was located a 30 in x 8 in. air diffusion grille in the bottom of the duct. The grilles of the main air discharge duct are of a type which permit the air diffusion point to be adjusted to permit direction of the air flow as desired.

The exhaust system in the kitchen was designed to draw air across the top of the range, thus taking the heat directly off the hot surfaces and away from the crew. Since only one exhaust fan is used, all the fresh air to the kitchen passes over the crew before contacting the highest heat sources, and then is ducted to the outside of the car. The exhaust system over the range consists of two inter-connected ducts leading to a 2000 cu. ft. per min. exhaust fan in the ceiling. The exhaust volume is controlled by dampers in the exhaust ducts. A modified mushroom type hood is installed over the exhaust fan outlet on the roof; louvered outlets are provided on each side of this hood, the forward and aft position of the hood being closed off. Two grease filters are installed at the entrance of the exhaust duct above the range, and two drip pans are provided beneath these filters. A single speed switch controls both the intake and exhaust fans and it is located adjacent to the entrance door of the kitchen.

A northeastern railroad built ten conventional floor plan diners having pantries and kitchens air-conditioned. A 3-ton refrigeration capacity split evaporator unit is located above ceiling at lobby section. This unit supplies 800 cu. ft. per min. of conditioned air, all fresh. 700 cu. ft. per min. of the supplied air is delivered to pantry and kitchen through duct and ceiling diffuser to these two sections. The balance of 100 cu. ft. per min. of air is delivered to kitchen end of passageway.

The air is exhausted from the kitchen by a 600 cu. ft. per min. air capacity centrifugal fan located over passageway at kitchen end of the car. For the pantry, a 200 cu. ft. per min. propeller type exhaust fan is provided.

There are no windows or other means of ventilation in kitchen or pantry than the air-conditioning system previously described.

The dining room of these cars is equipped with a five-ton refrigeration capacity evaporator unit, arranged in the conventional manner. Both the three-ton kitchen and five-ton dining room air-conditioning units are operated from separate compressor and condenser units beneath the car floor.

Air Conditioning of Suburban Cars

In air-conditioning the double deck multiple unit suburban cars on one railroad, the problem was approached on the basis that sufficient cooling should be provided to afford "comfort" conditions during the relatively short period the passengers are in the cars. On this basis, the retired tonnage was kept within reasonable limits, and an adequate precooling period was designated to lower the car temperature before the admission of passengers at the originating terminals. These cars, which have a seating capacity of 132 passengers, have been in use approximately four years and have given excellent service.

The air-conditioning system includes a 6½-ton direct expansion air-cooled Freon refrigerating compressor, belt driven from a 13 hp. compound wound, 1470 r.p.m., nominal 600-volt d.c. motor, and an extended surface air-cooled type condenser with a 1 hp. compound wound, 1750 r.p.m., nominal 600-volt d.c. condenser fan motor. The overhead air-conditioning unit consists of a 6½-ton extended surface type evaporator, a 2000 cu. ft. per min. duplex blower, belt driven from a 1 hp., compound wound, 1750 r.p.m. nominal 600-volt d.c. motor and two banks of 325-volt, 600-watt each strip heaters (total 14.4 kw.). The floor heat consists of 78 strip heaters, 325-volt, 600-watt, each located beneath the seats in the lower deck and in the side wall for the upper deck seats.

Approximately 450 cu. ft. per min. of fresh air is taken from the vestibule of the car through a suitable ceiling grille and viscous type filter, mixed with approximately 1550 cu. ft. per min. of filtered recirculated air, cooled and dehumidified in the overhead air-conditioning unit, and then distributed to all areas of the car through a center deck duct having a continuous perforated outlet plate.

A 12 in. propeller type ceiling exhaust fan, which provides for the removal of vitiated air, is arranged for operation on nominal 660 volts d.c. service.

All motors are designed for a voltage range of 400 volts to 700 volts d.c. and are capable of withstanding a hi-pot test to ground of 2500 volts (r.m.s.) a.c. for one minute.

The temperature control and compressor motor control circuits are arranged for nominal 32-volt d.c. (range 27 to 45 volts) service.

The master air-conditioning control panel has a single selector drum type switch with positions for heating, ventilating, off, and three positions of cooling—low, medium, and high. Mercury tube type thermostats are employed for temperature control. Bimetallic thermostats, located on the down stream side of the overhead heating elements, are employed to disconnect these heaters in the event of a fan failure and thus prevent overheating of the elements.

Twenty postwar 100-passenger 85-ft. suburban coaches were

purchased by one railroad in 1949, twelve of which are air-conditioned. The balance of eight are equipped with a pressure ventilation system.

The air-conditioned cars are equipped with a 220-volt three-phase 60-cycle 25 kw. diesel alternator power unit, supplying power for the air-conditioning system and car lighting. The evaporators are located above ceiling at center of the car, handling approximately 3000 cu. ft. per min. of air which is discharged equally to center ducts toward ends of car and distributed to car through perforated ceiling panels.

The fresh and recirculated air is admitted to a common plenum chamber through separate filters, and so proportioned to provide approximately 0.1 in. w.g. positive pressure in cars with doors closed. Exhaust air is handled by roof vents located at either end of the car. The operation of the cooling system is thermostatically controlled.

For heating, electric resistance heaters are located in air duct above air distribution panels. These electric heaters carry heating load down to outside temperature of 25 deg. F., below which heating capacity is supplemented by the conventional steam overhead radiator.

The pressure ventilation system, with which the balance of eight cars are equipped, consists of the installation of four vertical pressure propeller type fans, mounted flush with a dropped ceiling. The space between the dropped ceiling and inside lining of roof forms the plenum chamber for the air supply to fans. The fresh air is admitted through roof grilles to filters, and recirculated air is returned to plenum chamber through ceiling grilles and filters. Each fan is protected by duct baffles, so that the respective fans are each supplied by their own intakes for fresh and recirculated air.

For seasonal control of air volume and proportioning of fresh and recirculated air, the fresh and recirculated air grilles are equipped with dampers, manually operated, and also, the air volume of the fans is varied by thermostatic control. The damper settings are as follows:

1. Summer Operation—Fresh air intakes wide open, recirculated air grilles closed.
2. Spring and Fall—Both fresh air intakes and recirculated air grilles partly open.
3. Winter Operation—Fresh air intakes closed, recirculated air grilles open.

The 64-volt fan motors are thermostatically controlled to operate all four fans at full speed in parallel above 85 deg. F.; below 85 deg. F. and above 75 deg. F. the fans operate in series parallel; and below 75 deg. F. the four fans are in series.

Thirty double deck gallery type suburban coaches were purchased by one railroad in 1950. Twenty-five cars, without toilets, seat 148, and five cars, equipped with toilets, seat 145. The entrance to the car is through two automatic sliding doors at each side of car at center of car.

Each car is equipped with two propane-driven ice engines and two evaporators. Each evaporator has a capacity of 6½ tons. The two air-conditioning units are located above ceiling at center entrance vestibule. Each air-conditioning unit handles 2400 cu. ft. per min. of air. The fresh air is taken in through grilles in lower section of roof at both sides, above entrance doors. The air is discharged into the upper level from a central overhead duct. For the main floor space, the air is distributed from diffuser located beneath the gallery. Conventional steam heat fin tube floor heat radiation is provided on wall side, both ends. The cooling is thermostatically controlled by manual selective automatic thermostats with three settings, 71-73 deg. F., 74-76 deg. F., and 78-80 deg. F.

Electronic Filters

Concerning the use of electronic filters, the report states that while this type of filter provides an effective method of cleaning the air, it also presents problems of maintenance, the solution of which will be extremely difficult. The committee feels that this type of filter, in its present state of development, is both uneconomical and impractical on passenger cars.

Temperature and Humidity Control

The report states that the desirability of the completely automatic panel in sleeping cars is questionable, and it is the opinion of the committee that on cars which have an attendant in charge, at all times while occupied, a modified version of the automatic panel which will permit reasonable variations to suit individual demands is necessary.

It is the consensus of the committee that on non-sleeping cars a semi-automatic panel having three positions on the selector switch, including off and two temperature positions, is desirable. The particular temperature values of the associated thermostats should be designed by the individual railroad.

Heating of Passenger Cars

The report of subcommittee No. 4, assigned to a general study of heating of passenger cars consists of a brief history of the development of car heating. It makes interesting reading and should be of considerable value as background information to all who are responsible for the design, operation and maintenance of car heating equipment.

Subcommittee No. 6 on waste product heating did not report.

Mechanical Refrigeration

Assigned to investigate mechanical refrigeration for purposes other than air conditioning, subcommittee No. 6 produced a report divided into two parts. The first of these outlines a recommended procedure for the inspection and maintenance of electric water coolers. In this it recommends that water temperature be kept between 45 and 50 deg. F.

The second part of the report, which concerns the performance of a Carbofreezer dry-ice refrigerator, describes a test designed primarily to develop information on stratification and offers the following conclusions:

The tests indicate that there is no more objectionable stratification in this type of refrigerator than any other type; however, they do indicate that the already good performance of the Carbofreezer can be improved by the installation of a circulating fan. The use of a fan may be objectionable, due to the maintenance and wiring involved. Therefore, application of a baffle around the outside of refrigerant coil may assist in also alleviating the extreme temperature differential, but no tests were made along this line. In any event, the thermometer can be installed near the controlling thermostat, if thermostat is properly located to give a representative temperature of the entire box.

The location of the controlling thermostat on units that were tested was on the side wall, away from the ice compartment, was satisfactory and controlled very close to its setting. However, some boxes have been observed that had thermostats located near refrigerant coils under the unit, which was unsatisfactory due to frost building up on and around the thermostat, causing unstable operation.

As the consumption of dry ice will naturally depend on the size and type of box, and whether refrigerator doors are opened frequently, tests have developed that kitchen refrigerators will use approximately 2½ lb. of dry ice per hour, and bar refrigerators will use approximately 1 lb. of dry ice per hour, during normal operation.

One railroad that is an extensive user of dry ice refrigeration in dining and lounge cars feels that this type refrigeration is a sound improvement over wet ice boxes, due to being more economical in cost of ice and over mechanical refrigeration due to the low cost of maintenance.

As a matter of information, the latest Carbofreezer units are being equipped with a self-acting mechanical valve to control the circulation of the refrigerant, in lieu of the electrical thermostat and associated solenoid valve, thereby eliminating the necessity of conduit and wiring into the box.

The final section of the report consists of recommendations for revision of the Electrical Section Manual and deals with maintenance procedures for motor-operated steam valves, pressure-reducing valves, refrigerator units and direct-mechanical air conditioning equipment.

The report is signed by a committee of which K. T. Benninger, general electrical supervisor, Chicago and Eastern Illinois, is chairman.

Discussion

W. S. H. Hamilton (N. Y. C.) asked if the three positions of the selector switch referred to in the report were OFF, HEATING

and COOLING. Chairman Benninger replied that they are either OFF, DAY and NIGHT, or OFF, HIGH and LOW, with automatic control of heating and cooling.

R. I. Fort (I. C.) asked if there were at present any applications of waste product heating and Mr. Benninger replied that experiments were being made and that the committee would cover these in a later report.

The report recommends drinking water temperatures between 45 and 50 deg. F., and it was suggested that 50 to 55 deg. F. might be low enough. A general discussion indicated that most members preferred the lower range, while a number would like to have it still lower. One reason for this opinion is that when a passenger comes from an adjoining car, having ice-cooled water into one with mechanically-cooled water, in the 50-55 deg. F. range, he gets the impression that the system is not working. R. I. Fort (I. C.) said it was his understanding that the U. S. Public Health Bureau puts a floor on minimum drinking water temperatures, and suggested the committee find out what it is.

No report was made on the committee's assignment to explore developments of sealed refrigerating units, and W. S. H. Hamilton (N. Y. C.) said the committee should keep in mind the fact that inverters for producing 3-phase, a.c. power are now available in much larger sizes than heretofore. C. E. P. Smith (Frigidaire Division—General Motors) said his company now has a 7½-ton sealed unit which is water-cooled and may have an air-cooled unit. E. L. Morris, (E. A. Lundy Co.) said it is possible to produce sealed units in sizes above 4 tons if the railroads want them. W. J. Madden (Pennsylvania) added that the Westinghouse Electric Corporation has produced a sealed reciprocating unit of 5 tons capacity and that there are sealed water-cooled commercial units for stationary service of 25 and 30 tons capacity.

W. S. H. Hamilton (N. Y. C.) asked how many roads phase their standby power to run motors in one direction only, when connection is made with either side of the car and how many have phasing opposite on opposite sides of the car to permit checking operation of equipment in both directions. With the latter arrangement, it is possible to cause a short circuit by plugging in power on both sides of a car. Most members expressed preference for the two-way rotation, and apparently feel that ordinary safety precautions can prevent trouble from this cause. It was also pointed out that unless proper precautions are taken, phase rotation may be reversed when plugs and portable cables are repaired.

Concerning by-product heating, K. H. Gordon (Pennsylvania) said his railroad will have eleven diners with undercar power plants on which by-product heating will be used, both for heating of water and space heating, by employing both jacket and exhaust heat.

L. C. Bowes (C., R. I. & P.) said apparently no railroad ever has any trouble with air conditioning equipment. In response, J. A. Andreucetti (Secretary Emeritus) described some failures in his experience, and spoke of fumes developed by engine-operated equipment in terminals.

A. L. Kelly (M. P.) said that trouble is practically certain if it is necessary for an axle-powered car to stand for 2 or 3 hours. A. E. Voigt (A. T. & S. F.) said the best possible means of avoiding trouble is to get the maintenance man to understand the importance of his job. He added that when it is realized that air conditioning maintenance is of equal importance to locomotive maintenance, better results will follow.

R. F. Dougherty (U. P.) said that tests he had made showed that a 1,000-amp.-hr. battery on a car would operate all car equipment for 2½ hours before the low voltage took the load off the line. He added that in actual service cars had operated longer than this, since, the tests were more severe than conditions normally found in practice. He said batteries are a pretty reliable source of power. A. E. Voigt (A. T. & S. F.) concurred that the battery is a reliable source of power, but said that its capacity must be understood. He told of a case in which five trains were marooned in the recent flood at Emporia. Power was supplied with utility company power, and engine-driven welding sets. He said that with engine-driven power, a supply of fuel is necessary and added that with batteries augmented with usually available outside power, almost all conditions can be met. Mr. Kelly agreed to the reliability of battery power, but said the service it can give is limited, adding that it must be supported by expensive standby power facilities. He said, also, that he considers engine power to be highly reliable.

H. W. Dillon (S. P.) described tests made on the Southern Pacific in which cars were operated for six hours on the battery. He also said that they have been operated on the road for seven hours without complaint from the passengers.

W. S. H. Hamilton (N. Y. C.) said the New York Central uses 32-cell, 600-amp.-hr. batteries on its air-conditioned cars and that the general results of tests made at 125 amp., which is top load, the batteries operated from 1¾ to a little more than 2 hours, after which the batteries would operate the blowers for 4 and 5 hours. He said the controls could be so arranged that modulated or reduced air conditioning would be used whenever operation was from the battery alone. He expressed the opinion that both axle- and engine-driven generators have a place and added that diesel engines fail as well as axle generators.

J. E. Gardner (C. B. & Q.) said that in reporting such tests, the outside temperature and state of charge of the battery should be included.

Chairman Bowes put the question, "Why do we have failures?" A. L. Kelly (M. P.) responded by saying, "It is a maintenance problem." A man in the yard, he said, is frequently busy and lets a car go to the next trip. Closer attention, he said, will help. J. E. Gardner (C. B. & Q.) said there is plenty of automatic control, and that he would like to get rid of a lot of gadgets. He said he thought everyone would agree that the majority of failures are caused by minor equipment. He added that one important source of difficulty is due to the high turnover of manpower.

G. R. Berger (George R. Berger Co.) called attention to the fact that a battery which has a capacity of 1,000 hours at the 8-hr. rate, will have about half that capacity when discharged in 3 or 4 hours, and not more than one-fourth rated capacity when discharged in 2 hours.

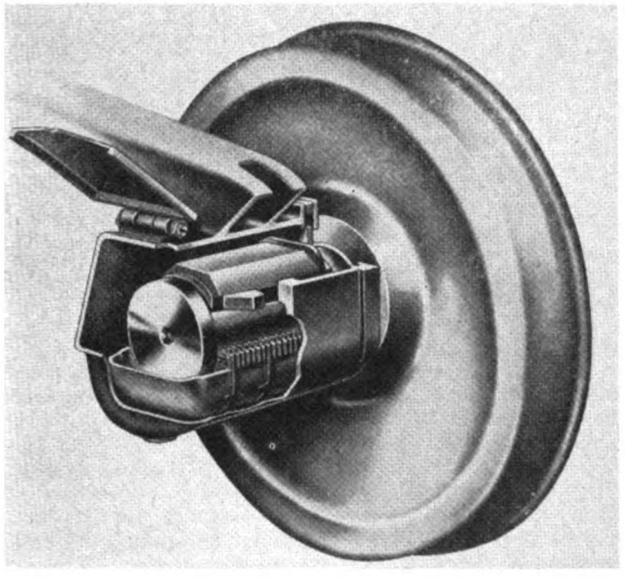
R. F. Dougherty (U. P.) took exception to the statement that control equipment causes most of the failures. These are, he said, usually caused by someone not doing his work properly and are not limited to control equipment.

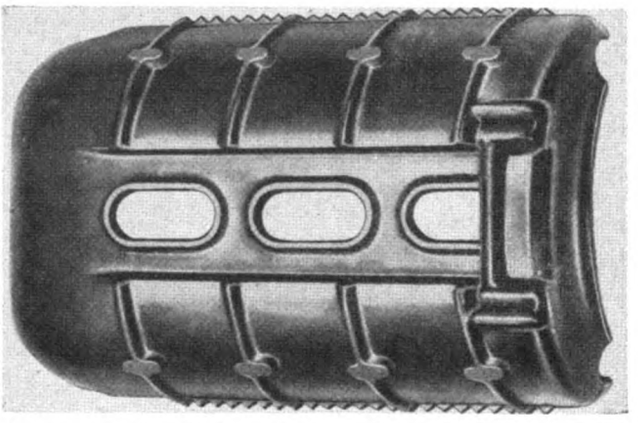
W. J. Madden (Pennsylvania) said that it was his experience that it was possible to obtain 4½ hours of air conditioning service from a battery with 6 to 7 hours service for blowers and lighting through the amplidyne inverter. He added that difficulties were frequently increased by improper operation of the equipment by the train crew.

K. H. Gordon (Pennsylvania) produced figures to show that out of 36 air conditioning failures, 5 were of doubtful origin, 11 were due to crew failures, and 20 were bona fide equipment failures. In response to a statement that air conditioning failure occurred in third-rail electrified territory, Mr. Dougherty (U. P.) said that the head-end power they had had was like third rail power, and that they had control failures on these trains. He added that, however, most of the failures were due to insufficient maintenance. Roy Liston (A. T. & S. F.) said everyone agrees on causes of failures, but no one has offered means of correcting them. He suggested that conditions can be greatly improved by better training of maintainers and, having a form sheet kept in each car, showing what had been done by what man. Mr. Dougherty said he had used cards without too much success, because, although the maintainer had done the work assigned to him, the car might still go out with a ground, with a dead battery or with a generator not working. It is better, he said, to follow the man and see that the work is done than to find out why the car failed. H. J. Dawson (I. C.) expressed the opinion that most supervisors should be complimented on the work they are doing. He explained this by saying that while the Interstate Commerce Commission says certain things shall be done, generators, etc., do not insist upon it.

In support of his suggestion for using cards, Mr. Liston said one need not sit in the office and wait for cards to come in, but that they provide a valuable check. Mr. Dougherty replied that the oldest men in service are causing the most trouble, and the new men, properly trained, and interested in the job, are good for satisfactory maintenance. Chairman Benninger agreed with Mr. Dougherty and said that when railroads get to the point that they hold cars with failed equipment, they will begin to make progress.

The report of the Committee on Automotive and Electric Rolling Stock and the L.M.O.A. report on cleaning and testing of traction motors, main generators and other electrical equipment will be covered in the December, 1951 issue.





▲ Bottom view of the package retainer showing the trough for added resiliency and the holes in the trough which permit waste to contact free oil in the bottom of the journal

◀ Cutaway view of a journal box showing the Hulson retainer in place

Package Type Waste Retainer Tested on Two Roads

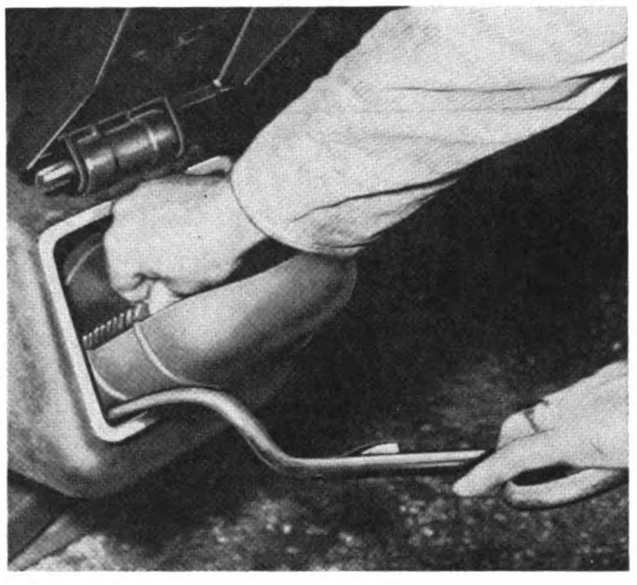
One of the newer developments for combating waste grabs, displacement of waste, hot boxes and other journal troubles is a package type waste retainer developed by the Hulson Company, Chicago, and included in the Association of American Railroads' list of packing retainer devices approved for roads desiring to use them as per Interchange Rule 101. This waste retainer and container is made of oil-resistant synthetic rubber with sufficient resilience to hold the waste against the full length of the journal at the proper pressure for adequate lubrication.

The container, trade-marked Flex-Pak, was originally designed early in 1947, and the first application was made in October, 1948, on the Chicago & North Western. Tests on this application showed a possibility for reducing inspection cost considerably and for attaining savings in journal-box packing and in the labor of application. Since the original design, several changes have been made to improve the performance of the retainer, and the present model was adopted in June, 1950.

Additional experience with Flex-Pak has been gained on the Pennsylvania. Twenty-five B60B head-end cars so equipped have gone through the second brass change with no hot boxes due to the Hulson container.

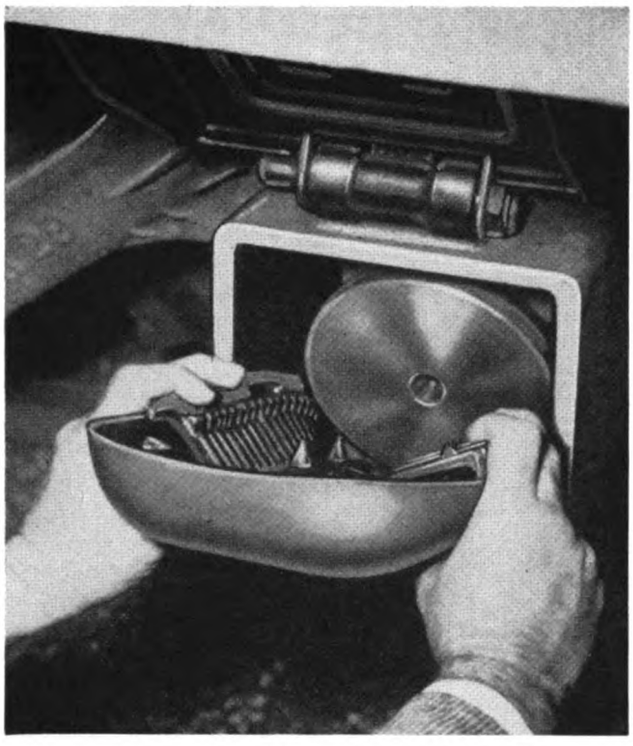
In stationary laboratory tests the Pak and box were chilled down to 50 deg. below zero, and there was no displacement of the Pak or the waste on the breakaway. At subzero temperatures the container loses pliability, becoming stiff and hard but not brittle. It tends to freeze to the box. The lips stiffen to help hold the waste in place.

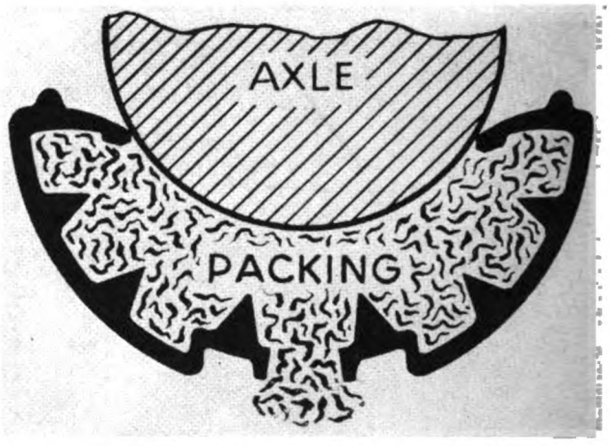
▼ By using a packing iron underneath the retainer to work it into place, it can be forced in with the free hand



Application of the Hulson retainer is simple. It can be applied to standard A.A.R. boxes without removal of the brass. It fits underneath the waste-retainer ribs in all sizes of standard boxes and in the same position in boxes without ribs. The Flex-Pak need be removed only at established repacking periods, at which time it should be thoroughly cleaned along with the box.

Some of the principal advantages claimed for the Hulson container in addition to its role in reducing hot boxes are: Only about half as much waste is required to





A Diagrammatic view of the operation of the Flex-Pak in keeping waste in place

< After all packing is removed and the bottom of the journal box cleaned, the Flex-Pak is wiped with oil, the combs folded downward at the fillet end, and container stuffed in the box

pack the journal box when the container is used, and the packing does not have to be set up after the car is humped. Impacts from all causes—low rail joints, rough coupling, surges in the train, etc.—are absorbed by the container which returns the waste to the proper position immediately. A trough along the bottom helps to improve the resiliency. Waste is prevented from rolling out under the collar by cone-shaped lugs in the bottom of the retainer. If packing is pushed out under the collar in service, this indicates too much packing.

Slots included in the bottom allow a certain amount of packing to be forced through the retainer when the waste is applied. This packing then acts as a wick to draw free oil from under the container. By adding free oil as required, both the journal brass and the combs of the container will be well lubricated, keeping wear of both to a minimum.

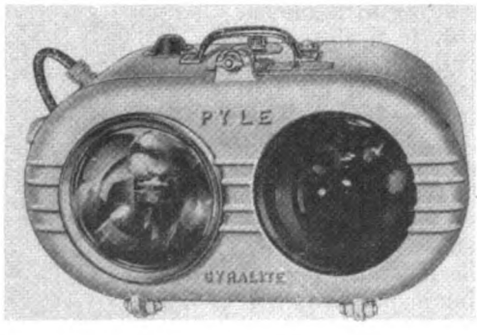
Reflector Type and Sealed Beam Lights

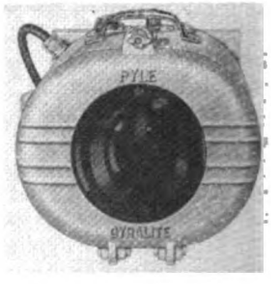
Recently available are two new type sealed beam Gyralites for general rear-of-train use, or for front of train use in slow speed service such as switcher locomotive and scale cars. One is combined with a sealed beam back-up light, the other without.

These Gyralites were developed to fill the need for more adequate train protection created by modern high-speed railroading combined with greater traffic density. The rear-end units provide an emergency warning beam of red light (or any other signal desired) to notify overtaking trains that a train ahead has slowed down or stopped.

Permanently mounted on observation or business cars or temporarily hung on rear-end cars (portable models) its high intensity moving beam travels in a circular pattern. The lowest point of the beam path is directed straight down the track. In the rest of its circular path, the

(Continued on page 134)









The Gyralite at the left is combined with a sealed-beam back-up light

High-pressure is built up only at the tip of GM unit injectors which measure, pump and atomize the fuel. There is no central measuring or pressurizing pump and hence no need for high-pressure fuel lines which rupture and break.

And here's the pay-off: GM's unique fuel injection system is so simple that fuel pumps and unit injectors can be replaced or rebuilt at but a fraction of the cost of replacing or rebuilding other types of Diesel fuel systems.



ELECTRO-MOTIVE DIVISION

GENERAL MOTORS GENERAL MOTORS LOCOMOTIVES LA GRANGE, ILL.

Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ont.

(Continued from page 130)

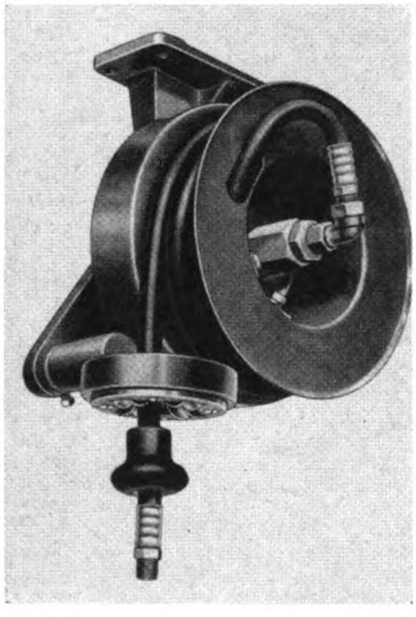
beam is projected upward and outward creating a brilliant sky effect and sweeping both sides of the right of way.

The two models are furnished with a type Par-56, 200 watt locomotive sealed beam lamp mounted in a 'gyrating' mechanism within a cast aluminum alloy housing. The combination model has in addition, a second Par-56, 200 watt lamp mounted in a door as a stationary white back-up light. Two types of automatic controls are offered, the air pressure type and the generator voltage type.

The automatic air control types operate when the air brake pressure changes from the selected air switch pressure setting. They continue to operate after the air pressure is restored and until manually reset by pressing the reset push button.

The automatic train speed generator control types are controlled through the car generator reverse current contactor. They are automatically turned on when the contactor is in the 'on battery' position when train is stopped or traveling at low speed; they are automatically turned off when the train regains speed and the contactor is in the 'on generator' position.

Manually controlled types are operated by the master selector switch provided in the top of the light or by remote control switches for operation from any desired point in the car. These units are available from The Pyle National Co., Chicago.



Tool Suspension and Air Supply Hose Reel

The combined tool suspension and air supply hose reel introduced by The Wayne Pump Co., Fort Wayne 4, Ind., is a compact, completely packaged unit easily installed over the work bench on high-speed production assembly lines. A pneumatic screw driver or other tool is suspended on the hose which supplies the air, requiring no cable suspension with separate air hose. Weight of the tool is counterbalanced by the spring tension of the reel.

Releasing the tool lifts it automatically to a predetermined convenient position directly over the work spot. Automatic uptake of tool leaves both hands free to remove work from machine. No wrenches, triggers, locks or other devices are necessary to change spring tension. Merely removing a turn or two of hose decreases tension and wrapping hose around the spool increases tension.

Fifteen ft. of ¼ in. inside diameter hose with male-fitting standard is provided. A rubber bumper stop is utilized to control length of travel when tool is released. Universal mounting brackets permit mounting on post, wall, or hanging cable.

Remote Indicating Engine Warning System

For engine application it is desirable to protect the engine against high water temperature, high lube oil temperatures, low lube oil pressure, etc. Controls and warning devices for this purpose take many forms. Basically, these systems give signals only when abnormal conditions develop. If the light does not flash, or the buzzer sound, it is assumed that a normal operating condition exists.

Tellite, developed by the Rochester Mfg. Co., Rochester 10, N. Y., gives three indications—light off—dim light—and flashed light. A dim, visible light glows when all connected units are operating normally. It remains dim when the engine idles. A temperature rise, low oil or air pressure, or any such conditions which would make engine operation unsafe or detrimental, causes the system to flash the warning: bright—dim, bright—dim. Thus the operator is always warned before serious damage is done.

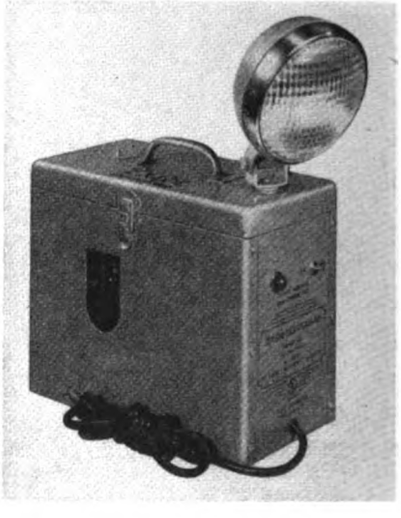
Tellite was developed to provide a flashing light signal to warn the operator of any engine malfunction which might result in damage to engine parts. Basically, it is a remote indicating, warning system, showing low oil pressure, low air brake pressure, excessive heat rise, generator failure or the partial set of the hand brake.

A strong point in its favor is a dim glowing light which always shows under normal conditions and indicates the system to be in working order. When this light is out, one of the conditions mentioned above has developed, and thus warns of its own failure.

Any number of pressure and temperature control switches may be used in this warning circuit without affecting the operation of this system. By this method, one warning light may be used for checking a large number of temperature and pressure points throughout an engine. The operator can easily determine the cause of the flashing light by checking his engine instruments. If preferred, however, one Tellite can be used for each separate part of the engine, as is the normal procedure on diesel locomotives, etc.

Many typical warning system applications require controls in conjunction with them. Typical of this are the warning and control systems installed on diesel locomotives. These are designed to warn of the source of trouble, using flashing lights and buzzers, and in addition reduce the speed, or stop the engine before a dangerous situation develops. The Tellite pressure and temperature switches are designed to serve this dual role simultaneously, or independently, if desired.

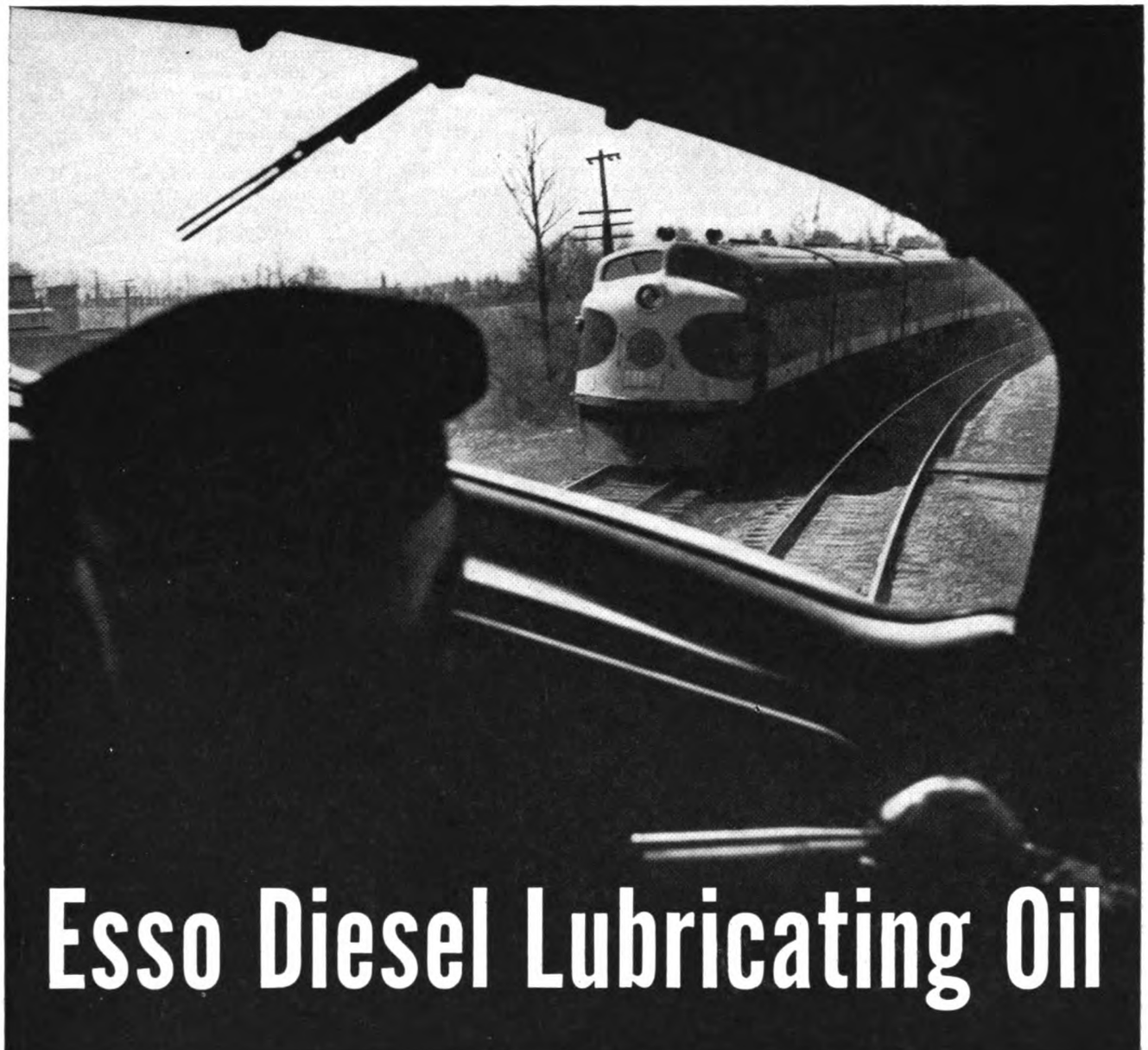
◆



Automatic Emergency Light

Insurance against light failures in large and small buildings is provided by the Exide Lightguard emergency lighting unit, made by the Electric Storage Battery Company, Philadelphia, Pa. Each unit is about the size of a portable typewriter and consists of one or two 25-watt sealed-beam floodlights with power supplied by a thick-plate glass jar storage battery. A magnetic switch automatically connects the floodlights to the battery when the normal current is interrupted. When the unit is not in use, its battery is kept fully charged from the regular electric circuit, since it is always plugged into an outlet. When normal power service is restored, a relay automatically turns off the flood-

"Tailor-made" for Railroad Diesels



Esso Diesel Lubricating Oil

A HIGH-QUALITY LUBE FOR REAL PROTECTION —Esso offers "tailor-made" diesel locomotive lubricating oil (Diol RD) developed through years of field testing and research by both engine designers and Esso scientists to meet needs of railroad diesels. High-quality Esso Diol RD gives dependable lubrication protection.

BACKED BY CONSTANT RESEARCH —continuing tests in the lab and on the road make sure that Diol RD keeps pace with progress and latest developments in railroad diesels.

BACKED BY CONSTANT FOLLOW-UP — on-the-job check-ups by Esso Sales Engineers watch the dependable performance of Esso Railroad Fuels and Lubricants. Be sure to call on Esso for any railroad fuel or lubricating problem.

The Sign of QUALITY

ESSO

The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

lights, and turns on the charging unit.

The lamps are adjustable to provide light in any direction desired. A single lamp unit will furnish light continuously up to six hours and two-lamp units will operate up to 2¼ hours, when the light output will be approximately 70 per cent of peak. The lights can be turned off by a manually operated toggle switch. When the toggle switch is turned to the OFF position, a neon pilot light goes out, indicating that the unit is not set for automatic operation. Pulling the plug at any time provides a simple way to test the automatic action of the unit, since this is equivalent to a power failure.

Adhesive Backed Felt Tape

A reinforced felt tape with a pressure-sensitive adhesive back has been announced by the Products Research Co., Glendale 3, Calif. Known as Kling Felt, it does not require a paper or other separation material between layers and can be applied very rapidly.

Uses for the product include rattle and squeak deadening; sealing against dust, wind, fumes and foreign materials; as a thermal insulator; for vibration and shock cushioning in fragile crating and on machinery; for scratch protection and protective applications such as electric control panel doors; weather-sealing; casket sealing for inter-state shipment; anti-squeak and seal on truck cabs; anti-scratch base for desk equipment, and a cushion for instrument shipping.

The adhesive back eliminates need for gluing or tying. The pressure of a finger will make it stay put on overhead and vertical positions until it is forcibly removed.

This felt is available in rolls from ¼ in. to 66 in. wide and in the following thicknesses: 1/64, 1/32, 1/16 in. (100 ft. long); ⅛ in. (50 ft. long); ¼ in. (25 ft. long). It is also available as a cut gasket, die-cut to specifications.

Indicating, Contact-Making Pyrometer

An indicating, contact-making pyrometer, known as the Alnor Pyrotac, is now being made by the Illinois Testing Laboratories, Inc., 420 N. La Salle Street, Chicago.

It is available either as a single circuit instrument or with a motor-operated selector switch.

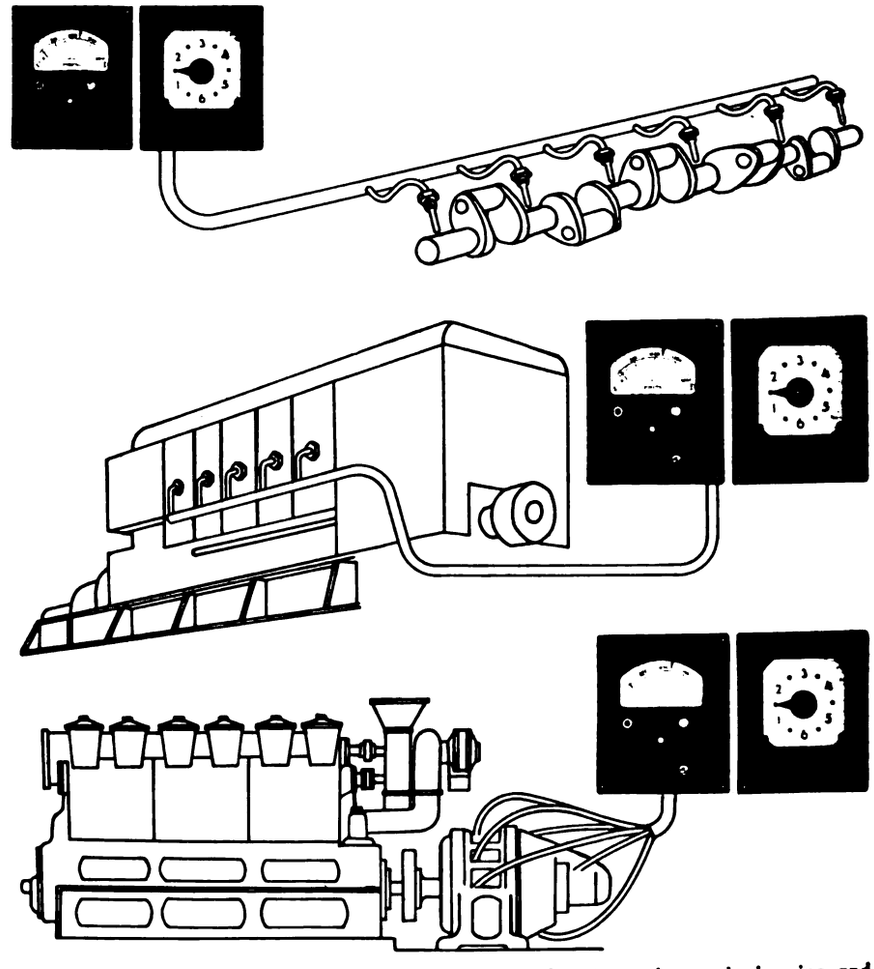
The pyrometer is designed to improve the instrumentation of a diesel or gas engine. It may, for example, be used to sound an alarm and automatically shut down the engine in case of an excessively high exhaust gas temperature for any one cylinder. In such installations, the instrument is connected in turn to the thermocouple in the exhaust stem from each cylinder once every minute. Should the exhaust temperature of any one cylinder be above the pre-determined maximum, the alarm will sound and the engine will be shut down. The pointer on the selector switch will stop at the number of the offending cylinder, thus facilitating the location of the source of trouble.

The automatic features of the Pyrotac and motor operated switch do not interfere with the customary use of an exhaust temperature pyrometer. By watching the pyrometer pointer for a period of one minute, the operating engineer can determine if one or more cylinders is out of balance. Because the switch is of the overlapping type (i.e., the new thermocouple is connected before the old thermocouple circuit is broken), the pyrometer pointer does not drop then to ambient temperatures between readings. Therefore, an out of balance condition is indicated by an appreciable motion of the pointer. If the operator desires to log the exhaust temperature of each cylinder, he may stop the selector switch at any desired cylinder by pressing a spring loaded button on the meter panel and then read the temperature. Releasing the button puts the instrument back in service continuously protecting the engine. When it is impractical to shut an engine down because of excessive exhaust temperature, the alarm feature may be used to warn the engineman of the dangerous conditions so that he can take the necessary steps to protect his equipment.

In a multiple engine plant, the Pyrotac could be connected to a couple in the common exhaust of each engine and thus sound an alarm if any one engine were overloaded. Similarly, a Pyrotac with a suitable range could be connected to the thermocouples in generator windings or bearings.

The meter movement in the Pyrotac is the same as that in Alnor pyrometers. The contact-making mechanism is non-electronic. The motor-operated switch is a comparatively radical design, but it has now had years of field use.

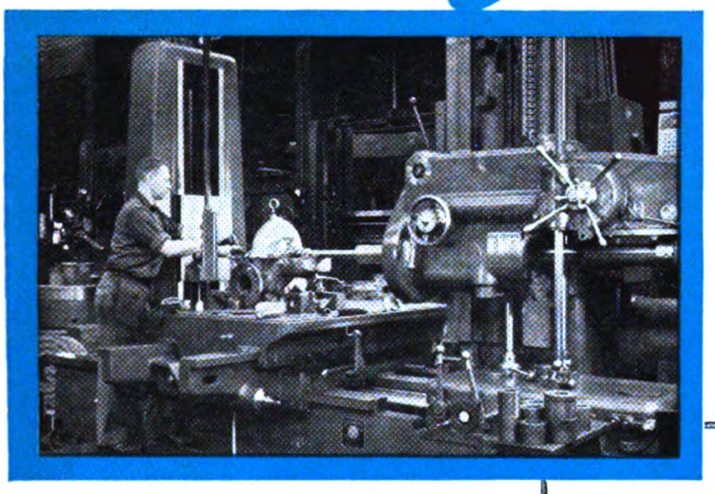
(Turn to page 160)



Applications of the Alnor Pyrotac to an engine exhaust, engine main bearing and generator windings

Fine Machine Work

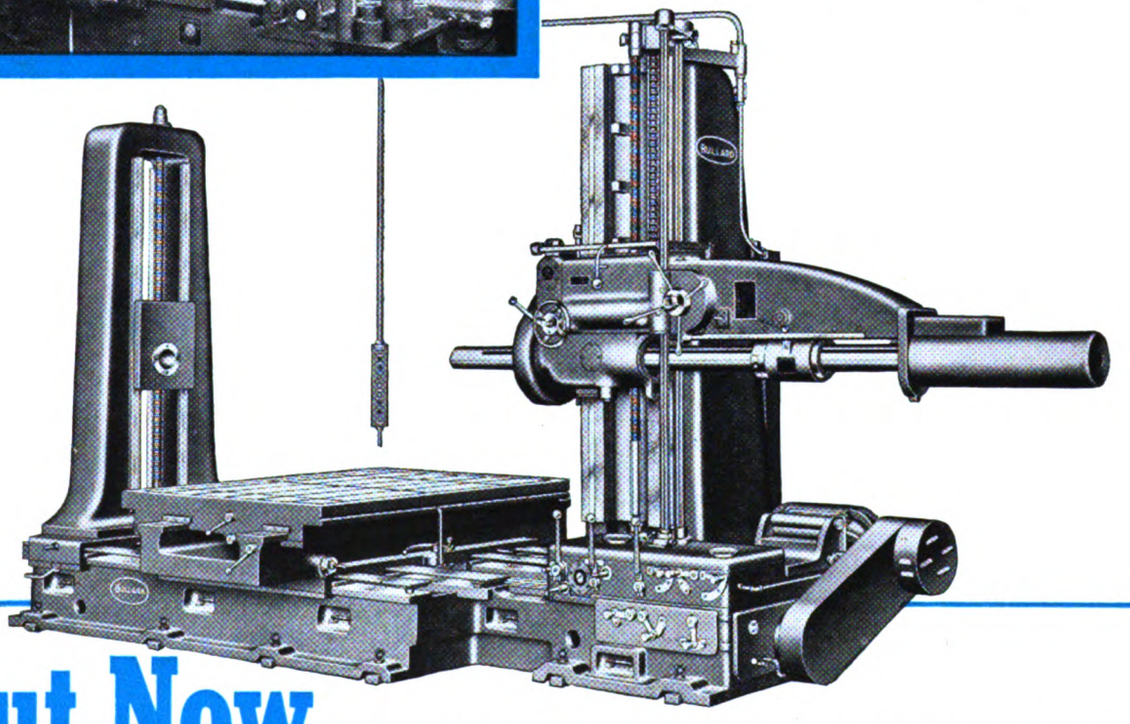
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NEWS

A.S.M.E. Annual Meeting To Be Held at Atlantic City

Chalfonte-Haddon Hall, Atlantic City, N.J., will be the headquarters for the 1951 annual meeting of the American Society of Mechanical Engineers which will be held November 26 to 30, inclusive. A registration fee of $5 will be charged nonmembers attending. For student nonmembers the fee will be $1. The banquet will be at 6:45 p.m., Wednesday, November 28. The program, in part, is as follows.

MONDAY, NOVEMBER 26
2:30 p.m.

Gas Turbine Power (II)—Power (I)

The Gas-Turbine's Contribution to Gas-Line Pumping, by T. J. Putz, locomotive and turbine engineering, Westinghouse Electric Corp.

A 5,000-hp. Gas-Turbine Power Plant, by Bruce O. Buckland, engineer, and Donald C. Berkey, section engineer, gas turbine engineering division, General Electric Co.

TUESDAY, NOVEMBER 27
9:30 a.m.

Panel Discussion: Effect of the Lubricating Oil Upon Diesel and Gas-Engine Performance:

Lubrication, by John Gibb, Socony Vacuum Oil Co.

Bearings, by E. W. Crankshaw, Cleveland Graphite Bronze Co.

Engines, by George Steven, Worthing Pump & Machinery Corp.

Filters, by F. Lee Townsend, manager, William W. Nugent & Co.

Liners and Pistons, by Stuart Nixon, Sealed Power Corp.

WEDNESDAY, NOVEMBER 28
2:45 p.m.

Railroad (I)

Economic and Efficient Lubrication of Waste Packed Journals, by L. D. Grisbaum, chief engineer, Railway Service & Supply Co.

Economic Study of Roller Bearings on Freight Cars, by O. J. Horger, chief engineer, Railway Division, Timken Roller Bearing Co.

THURSDAY, NOVEMBER 29
9:30 a.m.

Railroad (II)—Oil and Gas Power (IV)

Operating Experience of the Talgo Train, by Jerry M. Gruitch, director, research and development, American Car & Foundry Co.

Development of the General Motors Two-Cycle Railway Diesel Engine, by E. W. Kettering, chief engineer, Electro-Motive Division, General Motors Corp.

2:30 p.m.

Railroad (III)—Materials Handling (IV)

Progress in Railway Mechanical Engineering (Report of Committee RR-6 Survey), by T. F. Perkinson, committee chairman, manager, Commercial Engineering Division, Transportation Division, General Electric Co.

Symposium — Railroads and Highway Trailers—An Economic Solution to a Difficult Problem, by George L. Goebel, mechanical engineer, New York, New Haven & Hartford; H. R. Sampson, vice-president, Chicago & Eastern Illinois, and E. F. Ryan, president, Rail-Trailer.

Freight-Car-Parts Advisory Committee

The National Production Authority, U. S. Department of Commerce, has announced the following as members of the Railroad Freight Car Component Parts Industry Advisory Committee:

C. R. Auld, assistant to vice-president Railway, Steel Spring Division, American Locomotive Company, Latrobe, Pa.; Fred P. Biggs, president, American Brake Shoe

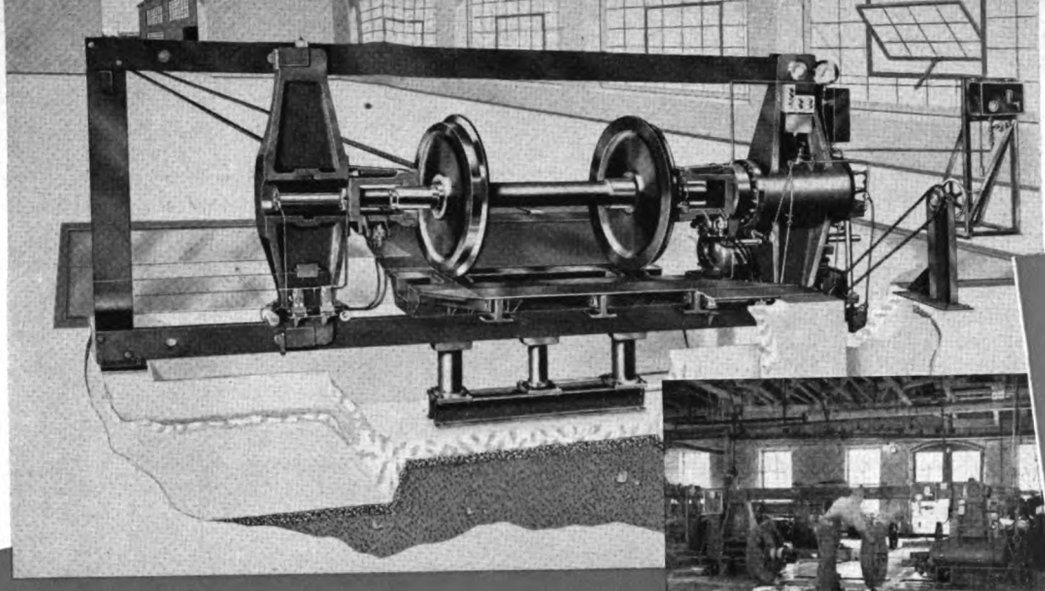
(*Continued on page 142*)

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of June 1951	Month of June 1950	6 months ending with June 1951	6 months ending with June 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	23,566	29,128	157,795	165,348
3-06	Total, Diesel-electric	22,744	17,100	128,600	97,696
3-07	Total, electric	836	826	4,962	4,843
3-04	Total, locomotive-miles	47,147	47,054	291,378	267,911
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,706	1,638	10,345	9,040
4-06	Empty, total	871	865	5,169	4,904
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	42,233	48,949	271,832	268,252
6-02	Total in oil-burning steam locomotive trains	11,950	14,363	73,280	70,246
6-03	Total in Diesel-electric locomotive trains	63,845	48,502	359,819	275,105
6-04	Total in electric locomotive trains	2,298	2,203	13,627	12,679
6-06	Total in all trains	120,333	114,025	718,653	626,395
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.05	1.05
10-02	Loaded freight car-miles	40.1	38.9	39.5	37.7
10-03	Empty freight car-miles	20.5	20.6	19.7	20.4
10-04	Total freight car-miles (excluding caboose)	60.6	59.5	59.2	58.1
10-05	Gross ton-miles (excluding locomotive and tender)	2,828	2,713	2,741	2,611
10-06	Net ton-miles	1,331	1,234	1,282	1,175
12	Net ton-miles per loaded car-mile (M-211)	33.2	31.7	32.5	31.2
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	66.2	65.4	66.7	64.8
14	Averages per train hour (M-211):				
14-01	Train miles	17.1	16.9	16.9	17.0
14-02	Gross ton-miles (excluding locomotive and tender)	47,777	45,329	45,791	43,805
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	45.9	46.8	46.1	43.3
14-02	All	43.8	43.8	44.0	40.3
15	Average net ton-miles per freight car-day (M-240)	962	907	953	814
17	Per cent of home cars of total freight cars on the line (M-240)	39.2	39.6	36.6	45.4
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	9,601	12,214	64,126	68,236
3-06	Diesel-electric	16,279	14,404	94,835	84,322
3-07	Electric	1,613	1,608	9,697	9,518
3-04	Total	27,493	28,226	168,658	162,076
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	269,456	271,043	1,630,372	1,552,578
4-09	Total in coal-burning steam locomotive trains	49,409	63,968	336,856	346,987
4-10	Total in oil-burning steam locomotive trains	33,232	38,487	199,615	210,325
4-11	Total in Diesel-electric locomotive trains	169,813	151,703	990,609	892,371
12	Total car-miles per train-miles	9.61	9.47	9.51	9.35
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
10-1	Steam, coal-burning	1,138	1,396	7,687	8,342
1-02	Steam, oil-burning	229	255	1,459	1,363
1-03	Diesel-electric[1]	2,906	2,473	17,346	14,132
1-06	Total	4,297	4,151	26,650	23,994
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	43	57	302	364
2-02	Steam, oil-burning	12	13	78	77
2-03	Diesel-electric[1]	240	227	1,436	1,331
2-06	Total	328	330	2,017	1,974
3	Hours per yard locomotive-day:				
3-01	Steam	7.4	8.2	8.0	7.6
3-02	Diesel-electric	17.1	17.6	17.5	17.3
3-05	Serviceable	14.2	14.2	14.5	13.8
3-06	All locomotives (serviceable, unserviceable and stored)	12.2	12.1	12.5	11.5
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.74	1.76	1.78	1.83
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.76	0.76	0.77	0.79

[1]Excludes B and trailing A units.

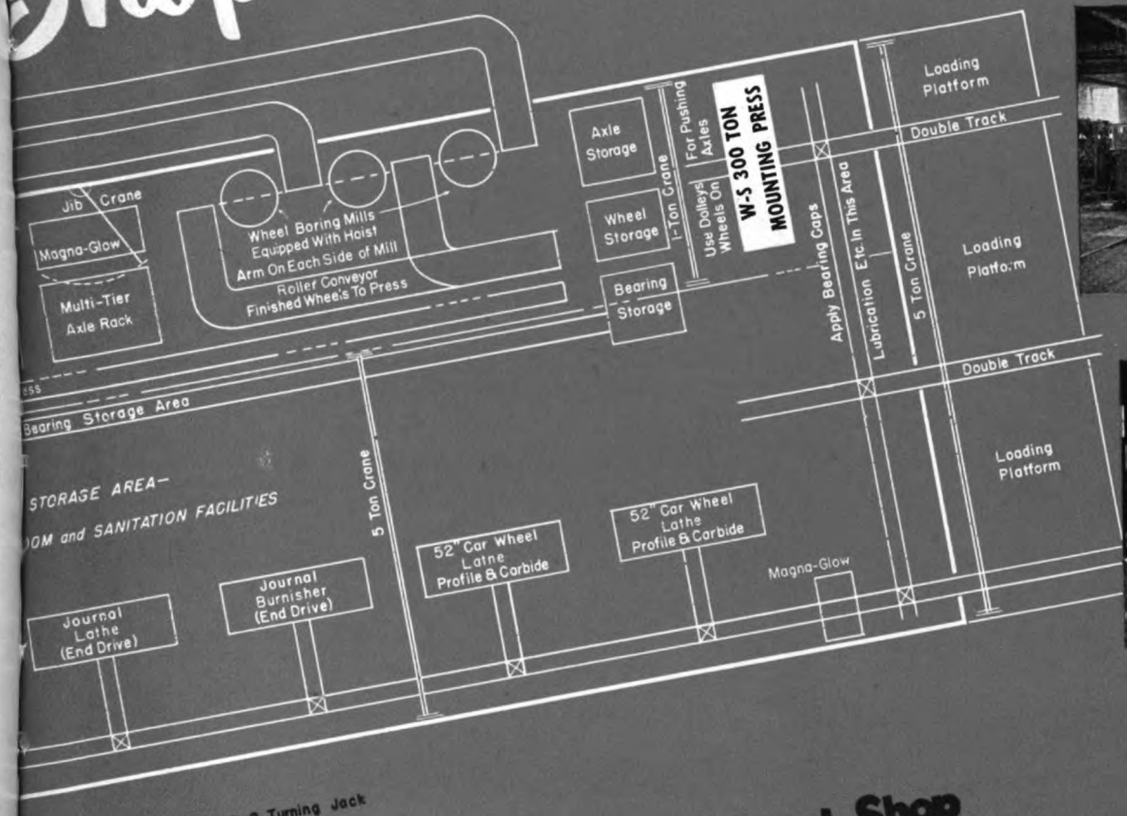


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Chicago 4, Ill. . . . . W. R. Walsh
Denver 2, Colo. . . . . Overgard Machine Tool Co.
New York 17, N. Y. . . . . Eastern Railway Supplies, Inc.
St. Paul 4, Minn. . . . . Anderson Machine Tool Co.
San Francisco 5, Calif. . . . . Overland Supply Co.
Washington 5, D. C. . . . . Ralph Payne

(Continued from page 138)

Company, Brake Shoe & Casting Division, New York; J. Ross Drever, assistant to vice-president, American Steel Foundries, Chicago; R. J. Brewniak, vice-president, Apex Railway Products Company, Chicago; Chas. E. Stevens, Jr., works manager, Chicago Railway Equipment Company, Chicago; Payson Smith, president, Illinois Railway Equipment Company, Chicago; S. T. Mendez, manager of District Office, W. H. Miner, Inc., Chicago; George L. Green, vice-president, Spring Packing Corp., Chicago; S. L. Beymer, vice-president, Standard Railway Equipment Manufacturing Company, Chicago; Charles L. Moorman, vice-president, Equipment Steel Products Division, Union Asbestos & Rubber Co., Chicago, and E. E. Robbins, vice-president, Youngstown Steel Door Company, Chicago.

SUPPLY TRADE NOTES

GENERAL MOTORS CORPORATION. — The first General Motors diesel locomotive built outside the North American continent was put into transcontinental passenger service in Australia recently. The diesel has 1,500 hp., is 61 ft. long and 14 ft. high, weighs 108 tons, has a maximum speed of 90 m.p.h., a maximum tractive force of 50,000 lb. and an axle load of 18 tons. The low axle loading permissible on the Australian tracks and bridges necessitated considerable redistribution of weight from the American design of the F type locomotive as well as the use of six-wheel trucks instead of the American design of four wheel trucks in this type locomotive. No train heating boilers are required. The space normally used for this equipment is used to house special engine-room air-filtering equipment made necessary by desert operating conditions. The locomotive carries 1,500 gallons of fuel oil, sufficient for its 1,051-mile run. It was built by Electro-Motive's Australian affiliate, the Clyde Engineering Company, Pty. Ltd., at Clyde, N. S. W. Power plant, transmission equipment and controls were supplied by Electro-Motive from LaGrange.

◆

PULLMAN COMPANY.—*George W. Bohannon*, has resigned as chief mechanical officer of the Chicago & North Western and has been appointed to fill the newly established position of manager, purchases and stores for the Pullman Company.

◆

LINCOLN ELECTRIC COMPANY.—*L. K. Stringham* has been appointed chief engineer for the Lincoln Electric Company of Cleveland. *G. G. Landis* continues as engineering vice-president.

Mr. Stringham was graduated from Cornell University as an electrical engineer and became associated with Lincoln Elec-

(Continued on page 144)

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE OCTOBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horse-power	Service	Builder
Atchison, Topeka & Santa Fe	10[1]	1,600	Switchers	Fairbanks, Morse
	14[1]	1,200	Switchers	Fairbanks, Morse
Canadian Pacific	6A	1,500		Canadian Loco.
	6B	1,600		Canadian Loco.
	6A	1,500		Gen. Motors Diesel, Ltd
	11B	1,500		Gen. Motors Diesel, Ltd.
	3	1,500	Road switch	Gen. Motors Diesel, Ltd.
	6	1,000	Switch	Montreal Loco.
	12	660	Switch	Montreal Loco.
Erie	3[2]	1,500	Gen. purpose	Electro-Motive
	2[2]	1,200	Yard switch	Electro-Motive
	4[2]	1,600	Gen. purpose	Alco-G. E.
	4[2]	1,600	Gen. purpose	Baldwin-Lima-Hamilton
Maine Central	1[3]	1,000	Switch	Alco-G. E.
Missouri-Kansas-Texas	10[3a]	1,200	Switchers	Electro-Motive
	10[3a]	1,200	Switchers	Baldwin-Lima-Hamilton
Montour	4[4]	1,200		Electro-Motive
New York Central	32A[5]	1,500	Freight	Electro-Motive
	32B[5]	1,500	Freight	Electro-Motive
	40[5]	1,200	Yard switch	Electro-Motive
	20[5]	800	Yard switch	Electro-Motive
	35[5]	1,600	Road switch	Alco-G. E.
	43[5]	1,000	Yard switch	Alco-G. E.
	18[5]	1,200	Yard switch	Baldwin-Lima-Hamilton
	17[5]	1,200	Yard switch	Fairbanks, Morse
Pittsburgh & Lake Erie	12[5]	1,500	Road switch	Electro-Motive
	10[5]	1,200	Yard switch	Electro-Motive
St. Louis-Southwestern	2A[5]	2,250	Passenger	Alco-G. E.
	4[6]	1,600	Road switch	Alco-G. E.
Union	11[7]	1,200	Switchers	Electro-Motive

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atlantic Coast Line	2[8]	50-ton "Unicel" box	Pressed Steel Car
Bessemer & Lake Erie	500	70-ton ore	Greenville Steel Car
Canadian Pacific	1,000	50-ton box	Canadian Car & Fdry.
	300	50-ton automobile	Canadian Car & Fdry.
	25	70-ton bagg.-exp.	Canadian Car & Fdry.
	1,200	50-ton box	Company shops
	400	50-ton freight refrigerator	National Steel Car
	300	70-ton covered hopper	National Steel Car
	350	50-ton box	National Steel Car
	25	50-ton express refrigerator	National Steel Car
	300	70-ton hopper	Eastern Car
	300	70-ton gondola	Eastern Car
Duluth, Missabe & Iron Range	250	70-ton hopper	Pressed Steel Car
Grand Trunk Western	350	50-ton box	American Car & Fdry.
	250	70-ton hopper	American Car & Fdry.
Great Northern	950[9]	50-ton box	Company shops
	50[9]	50-ton express refrigerator	Pacific Car & Fdry.
Louisville & Nashville	250	50-ton box	Pullman-Standard
Norfolk & Western	1,000	70-ton gondola	Virginia Bridge
Virginian	1,000	50-ton hopper	Bethlehem Steel

[1] Delivery scheduled for 1952.
[2] For delivery between January and May, 1952.
[3] Delivery scheduled for December.
[3a] This is orher for 20 locomotives reported in October but not divided as to builders.
[4] Delivery of these first non-steam locomotives for the road scheduled for 1952. Estimated cost, $425,000.
[5] Deliveries expected to begin in the second quarter of 1952 and to be completed early in 1953.
[6] For December delivery. Estimated cost per unit, $145,711.
[7] For delivery early in 1952. Estimated cost of each, $107,000.
[8] Delivery expected in the first quarter of 1952. Will be used exclusively on the A.C.L. for test purposes.
[9] Delivery expected during second quarter of 1952. The box cars will cost approximately $6,175,000; the refrigerator cars, approximately $1,300,000.

NOTES:

Army Transportation Corps.—The Army Transportation Corps is now procuring standardized railroad box cars for all four of the armed services. Replacing the former practice whereby each service procured railroad equipment of its own design, the single procurement method, which extends to all railroad cars and locomotives, is said to have aided standardization of government-used railroad equipment. A total of 212 50-ton box cars were recently procured by the Marietta Transportation Corps Depot, Marietta, Pa., from the Michigan City, Ind., plant of the Pullman-Standard Car Manufacturing Company. Of the cars—all "PS-1" units—150 were delivered to the Army, 39 to the Navy, 13 to the Air Force and 10 to the Marine Corps. The cars will be used principally to replace wornout equipment in intra-plant service within domestic military installations.

Minneapolis, St. Paul & Sault Ste. Marie.—The board of directors has authorized purchase of 20 diesel-electric locomotives costing about $3,200,000, and the building of 600 freight cars of various types in connection with its 1952 equipment program. The cars are to be built in the road's Fond du Lac, Wis., shops.

SUMMARY OF MONTHLY HOT BOX REPORTS

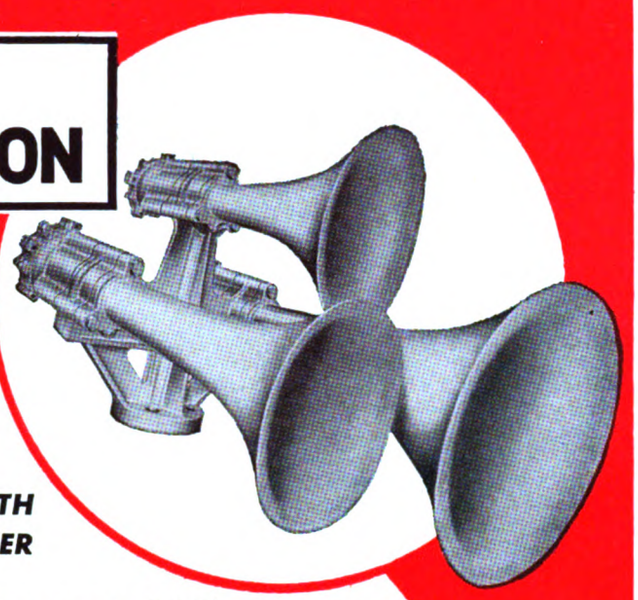
Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,590
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057

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- **TRUE MUSICALLY SHAPED HORNS**—To Produce Clearer Tones Like the Sound of the Steam Whistle
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SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
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tric in 1933. He has worked continuously in the engineering department and for the past two years has been director of welding development.

◆

AMERICAN HOIST & DERRICK CO.—*Peerless Equipment Company* has been appointed exclusive railroad supply agent and will handle American Hoist business with practically all railroads that headquarter in the Chicago area.

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY.—*Donald Petersen* has been appointed vice-president in charge of production of the *Standard Railway Equipment Manufacturing Company*, with headquarters in Chicago. He will direct all manufacturing activities at the company's plants in Hammond, Ind., New Kensington, Pa., and Lachine, Que.

Mr. Petersen came to Standard from Carnegie-Illinois Steel, where he spent five years in the Gary works and in Pittsburgh, later being on the staff of the vice-president in charge of industrial relations. He joined Standard Railway in 1944 as assistant to the president, and since that time has had an active management role in production



Donald Petersen

and operations. He was elected assistant vice-president a year ago.

Standard Railway Equipment Company is going ahead with certain units of its long-range modernization and expansion program for its Hammond, (Ind.) plant, although the cost, under today's conditions, may run somewhat higher than the original estimate of between $2½ million and $3 million. The program anticipates an additional 150,000 sq. ft. of factory floor space plus greater utilization of present space through modernization.

◆

H. K. PORTER COMPANY.—The H. K. Porter Company has acquired the *Buffalo Steel Company*, thus increasing its steel production capacity to over 200,000 tons.

◆

WORTHINGTON PUMP & MACHINERY CORP.—*Charles E. Wilson*, sales vice-president of the Worthington Pump & Machinery Corp., has been appointed a West Coast consultant on sales problems.

Mr. Wilson retired from his former position and activities in corporation affairs on October 1, but will continue in a consulting capacity at Worthington's offices in Los Angeles, San Francisco, Seattle and Salt Lake City.

◆

APEX RAILWAY PRODUCTS COMPANY.—*Edward T. Doherty*, president and director of Apex Railway Products Company, has been elected to the newly created position of chairman of the board. *Leo F. Duffy*, vice-president of the Youngstown Steel Door Company, has become president and director of Apex Railway Products.

Mr. Duffy is a graduate of Corpus Christi College, Galesburg, Ill. (1916). After serv-



Leo F. Duffy

ing in the U. S. Army in World War I, he was employed by the Chicago, Burlington & Quincy in various engineering positions. In 1926 he joined the Chicago Pneumatic Tool Company in its railroad sales division. In 1937 he became associated with Youngstown Steel Door.

◆

BLACK & DECKER MANUFACTURING CO.—*John F. Spaulding* has been appointed sales manager of Black & Decker, Towson, Md. Mr. Spaulding will supervise the sales of Black & Decker and Home Utility tools to distributors in the United States and Canada.

◆

IRVING SUBWAY GRATING COMPANY.—*Guilford S. Turner, Inc.*, has been appointed national sales representative for the Irving Company's Safkar grating products.

◆

AMERICAN BRAKE SHOE COMPANY.—*Pearce D. Smith*, sales representative for the National Bearing division of American Brake Shoe, has transferred from Pittsburgh to company headquarters, 230 Park avenue, New York. *Edward J. Roesch* has been appointed superintendent of the Meadow Lands, Pa., plant of the Brake Shoe and Castings division, and *Thomas P. Wallace* has been appointed superintendent of the division's plant at Buffalo, N. Y. *Thomas Baldwin*, formerly superintendent of the Meadow Lands plant, has retired.

Arthur N. Dugan, who has retired as vice-president of the National Bearing Division as announced in the October issue, started his career as a clerk with the Erie after his graduation from Rider College. In 1914 Mr. Dugan went into sales work, and later became vice-president of the Bronze Metal Company of New York. He became vice-president of National Bearing Metals Corporation in 1927 when that concern was formed. Later National Bearing Metals Corporation became a subsidiary, and then a division of Brake Shoe.

◆

ALLIS-CHALMERS MANUFACTURING COMPANY.—The electrical and mechanical power departments of Allis-Chalmers have been combined into a power department under the management of *R. M. Casper. F. W. Bush* has been appointed assistant manager in charge of the electrical section; *C. C. Jordan*, assistant manager in charge of the mechanical sections; *R. N. Miers*, manager of the steam turbine section; and *C. R. Braun*, assistant to Mr. Casper.

◆

PITTSBURGH STEEL COMPANY—William G. Gary, whose appointment as manager of railway sales for the Pittsburgh Steel Company was announced in the October issue, is a graduate of Pennsylvania State College. Immediately upon his graduation he joined the Lehigh Valley as a special apprentice, serving at different locations on the system. He later became foreman,



William G. Gray

and then general foreman in various L.V. shops, ultimately becoming special engineer at Bethlehem, Pa. He subsequently joined the Union Pacific at Omaha as engineer of freight car design; the Association of American Railroads as an assistant mechanical engineer, and the Virginian as master mechanic. He went with Pittsburgh Steel in 1944 as railway development engineer on tubular railway axles.

◆

TIMKEN ROLLER BEARING COMPANY—George T. Humphrey, Jr., has been appointed assistant general manager of the service sales division of the Timken Roller Bearing Company, with headquarters at Canton, Ohio. Mr. Humphrey formerly was assistant branch manager of the service sales division of Dallas.

◆

BALDWIN-LIMA-HAMILTON CORPORATION—About next January 1 the sales, engineering and manufacturing activities of the wholly owned subsidiary of Baldwin-Lima-Hamilton — the Whitcomb Locomotive

BLAZE





Company, of Rochelle, Ill.—will be transferred to the Eddystone, Pa., plant. This contemplated transfer will bring together at Eddystone all locomotive manufacture where ample facilities are available. The present Whitcomb plant at Rochelle will be used to provide space for expansion of the manufacturing activities of the Austin-Western Company, also a B.-L.-H. subsidiary.

◆

AMERICAN CAR & FOUNDRY CO.—*Wilbur E. Lunger* has been elected a vice-president of the American Car & Foundry Co., reporting to *R. W. Ward*, vice-president in charge of production. *Robert M. Noel* has been appointed sales agent at Chicago, reporting to *J. H. VanMoss*, western sales manager. Mr. Noel will represent A.C.F. in general railroad sales throughout the midwest territory which is under the general supervision of *P. A. Hollar*, vice-president in Chicago.

Mr. Lunger, a native of Danville, Pa., was formerly assistant vice-president in the production department. He studied engineering and for two years was trained in



Wilbur E. Lunger

shop work at A.C.F.'s Berwick, Pa., plant. In 1916 he was appointed field inspector in the export division and in 1923 became mechanical engineer at Huntington. He was made general superintendent there in 1937; district manager in 1946, and in November 1949 was transferred to New York as assistant vice-president.

◆

SKF INDUSTRIES.—*R. Robert Zisette, Gunnar Palmgren, Eric C. Brodin*, and *Karl Kesselring* have been elected vice-presidents of SKF, with headquarters at Philadelphia. Mr. Zisette is in charge of sales, advertising and market research; Mr. Brodin, in charge of manufacturing development; Mr. Palmgren, in charge of engineering and research, and Mr. Kesselring, in charge of production.

◆

SAFETY CAR HEATING & LIGHTING CO.—*Henry T. Stetson*, formerly vice-president of Safety, has been elected president to succeed Charles W. T. Stuart, deceased.

◆

CAMEL SALES COMPANY.—*Arthur J. Doyle* and *James D. Ryan* have been elected vice-presidents of the Camel Sales Company, wholly owned subsidiary of the

NOW TEST ARMATURE WINDINGS IN ONE OPERATION

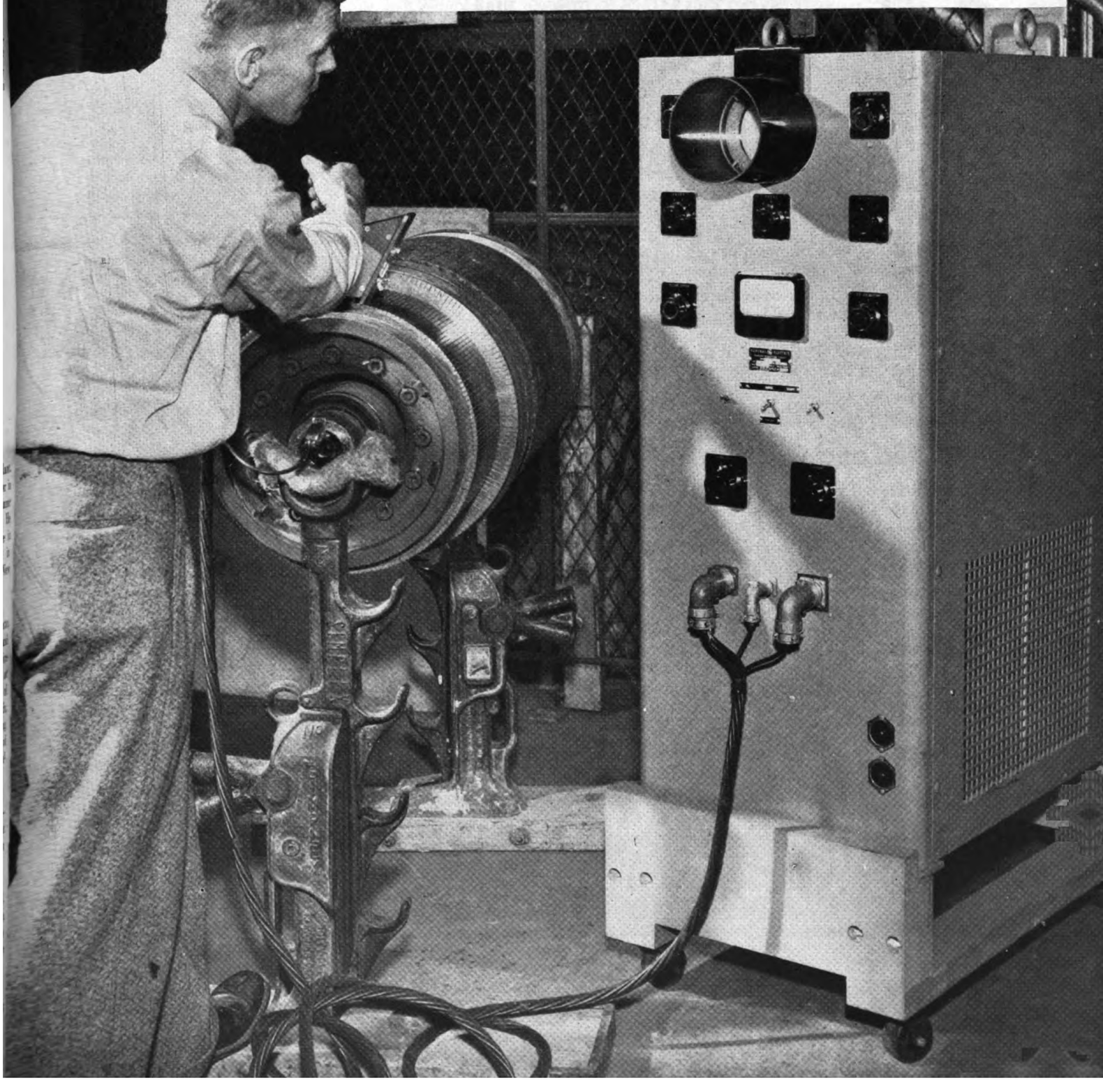
G-E's new winding insulation tester makes it possible for railroad shops to inspect armature windings quickly. In many instances windings can be tested in 10 to 15 minutes—saving time and money. The tester quickly locates a short circuit, even though the short may be on the inside of the armature.

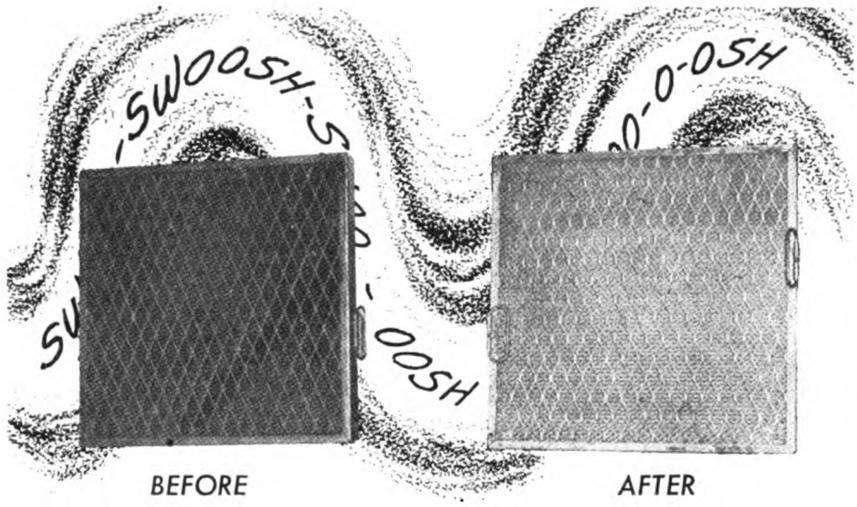
In addition, defective insulation on new and old armatures can be indicated. The tester provides the only way to stress turn to turn and coil to coil insulations many times normal operating value. For full details consult your nearest G-E representative. General Electric Co., Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

152-27





Cleaning and Oiling Air Filters the Magnus Way *is a Part-time Job for One Employee!*



Only part of the time of one unskilled worker is required to clean and oil air filters when you use the Magnus method.

You clean the filters in batches in the Magnus Aja-Dip Cleaning Machine, which moves them up and down IN the cleaning solution 54 times a minute. All clogging deposits are vigorously flushed out . . . quickly, thoroughly. Then you rinse, dip the filters in the Magnus Hot Oil Tank and dry them in the Magnus Dryer.

18 Large or 36 Small Filters Cleaned Rinsed and Oiled in Less Than 5 Minutes!

18 large filters (20" x 22" x 2¼") or 36 small filters (9" x 20" x 2¼") are loaded in baskets and agitated in the Aja-Dip Cleaning Machine for 1 to 2 minutes. Then they are rinsed for 1 minute in the Aja-Dip Rinsing Machine, after which they are dipped for 1 minute in the Magnus Hot Oil Tank. The filters are then dried in the Magnus Dryer.

You cannot get faster, better cleaning by any other method . . . and you also reduce your filter maintenance costs to the lowest possible level.

This equipment is in service in many of the famous lines of the country. Write us for the complete story.

Railroad Division

MAGNUS CHEMICAL COMPANY • **77 South Ave., Garwood, N. J.**

In Canada—Magnus Chemicals, Ltd., Montreal

MAGNUS CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

Youngstown Steel Door Company. Mr. Doyle has resigned as assistant vice-president of the parent firm. Mr. Ryan formerly was assistant vice-president of Camel Sales. *Emmett P. Dowling, Jr.*, formerly an employee of Youngstown Steel Door, has been elected an assistant vice-president of Camel.

Mr. Doyle began his career as draftsman for the Erie in 1929 and joined the Advisory Mechancial Committee in 1930.



Arthur J. Doyle

He became associated with Youngstown Steel Door in 1937 as a draftsman and in 1941 was promoted to sales engineer. In November 1944 he was elected assistant vice-president.

Mr. Ryan began his business career with Lawrence Stern & Co. as a bond salesman. In 1928 he joined the Ryan Car Company as a mechanic and later was appointed general manager and treasurer. From 1940



James D. Ryan

to 1944 he was shop supervisor in the small arms ammunition plant of the DuPont Company at Denver. Mr. Ryan joined the sales force of the Camel Sales Company as assistant vice-president.

Mr. Dowling worked on special assignments for the government out of Washington, D.C., during World War II. He resigned that position in 1946 to join Youngstown Steel Door.

◆

UNITED STATES STEEL CORPORATION.—*Orville F. Figley*, Chicago district manager for United States Steel, has been named assistant to vice-president—sales. *Keith P. Rindfleisch*, Pittsburgh district manager,

WASHING CUT FROM HOURS TO MINUTES
with a WHITING TRAIN WASHER

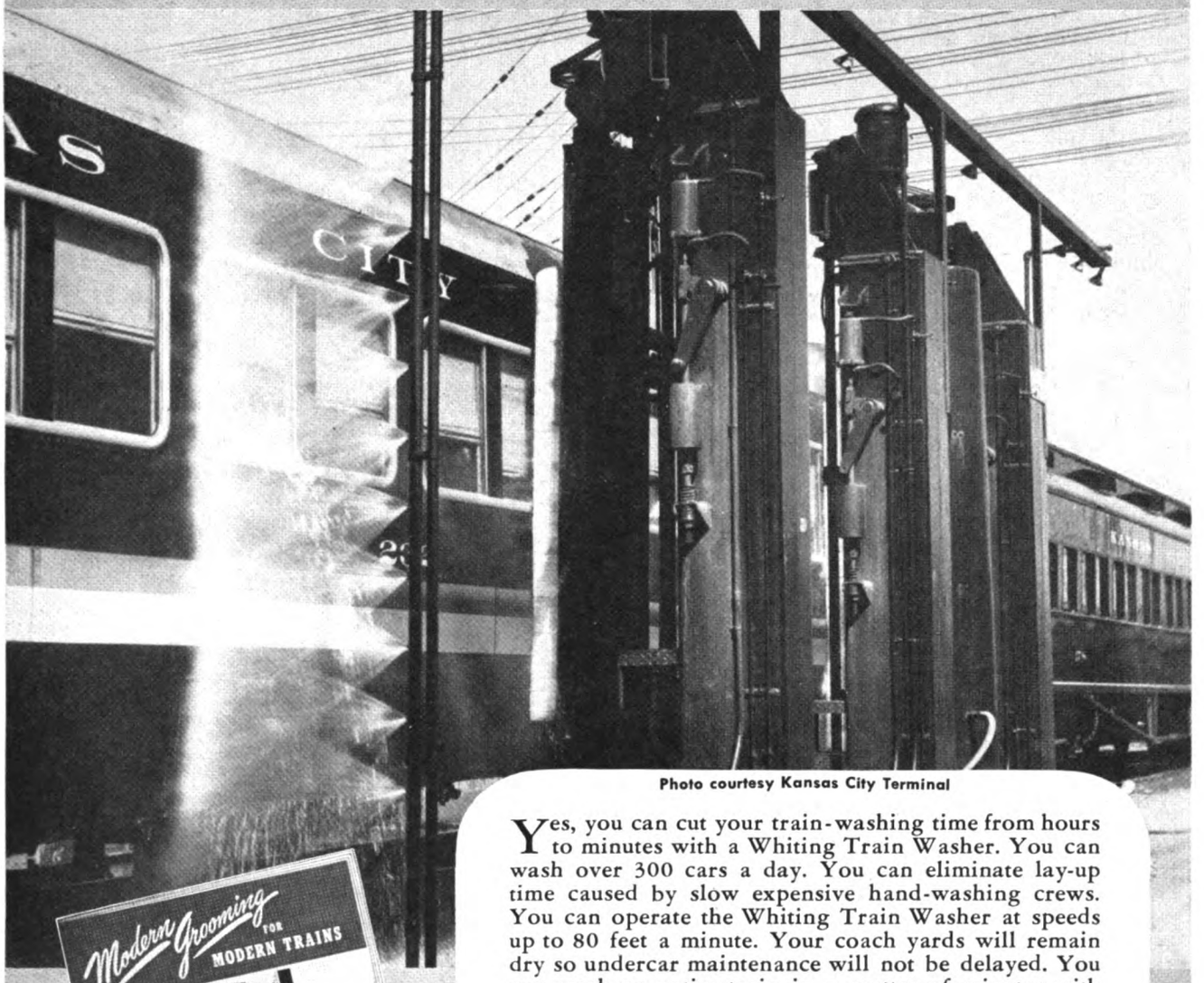
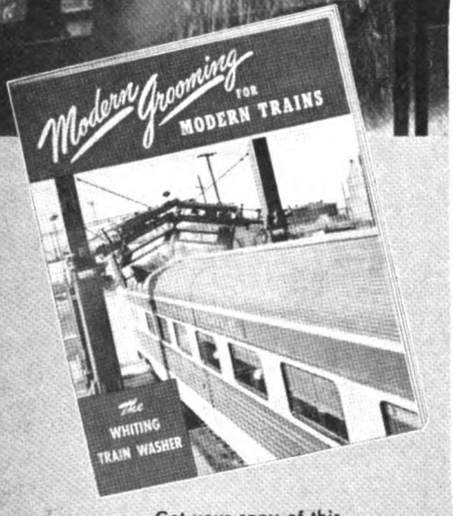


Photo courtesy Kansas City Terminal



Get your copy of this descriptive booklet.

Yes, you can cut your train-washing time from hours to minutes with a Whiting Train Washer. You can wash over 300 cars a day. You can eliminate lay-up time caused by slow expensive hand-washing crews. You can operate the Whiting Train Washer at speeds up to 80 feet a minute. Your coach yards will remain dry so undercar maintenance will not be delayed. You can wash an entire train in a matter of minutes with this modern method of train washing.

The Whiting Train Washer is obtainable in single- or multiple-unit installations that can be supplied with an extra attachment for washing roofs. Write for Bulletin CW-C-409 for more information.

WHITING CORPORATION

15609 Lathrop Avenue, Harvey, Illinois

RAILROAD MAINTENANCE EQUIPMENT

Offices in Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and Seattle. Representatives in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church Street, New York 7, New York

succeeds Mr. Figley at Chicago, and *Wesley N. Gordon*, manager of the alloy division, succeeds Mr. Rindfleisch.

◆

UNITED STATES STEEL SUPPLY COMPANY.—*Arthur I. Gibson* has been appointed manager of the newly formed sheet and strip division of the general sales department of United States Steel Supply Company. Mr. Gibson was formerly product representative for the company's sheet and strip division in Pittsburgh.

◆

VAPOR HEATING CORPORATION— *J. T. Elwood* has been appointed sales representative for the Vapor Heating Corporation, of Chicago, succeeding the late Dave J. Jones.

COPPERWELD STEEL COMPANY.—The Copperweld Steel Company, Glassport, Pa., has purchased all outstanding stock of the *Flexo Wire Company*, Oswego, N.Y. The latter will be operated as a wholly owned subsidiary of Copperweld.

◆

CHICAGO STEEL SERVICE COMPANY.—*Walter H. Creber, Jr.*, has been appointed manager of sales of Chicago Steel Service.

◆

THOMAS A. EDISON, INC.—*F. C. Anderson* has been appointed chief engineer of the Edison Storage Battery Division of Thomas A. Edison, Inc., to succeed the late Walter H. Patterson.

Mr. Anderson, formerly assistant chief engineer of the division, first joined the firm in 1931. In July 1946 he resigned to become chief engineer of the Storage Battery division of Baker & Co., but rejoined Edison last July.

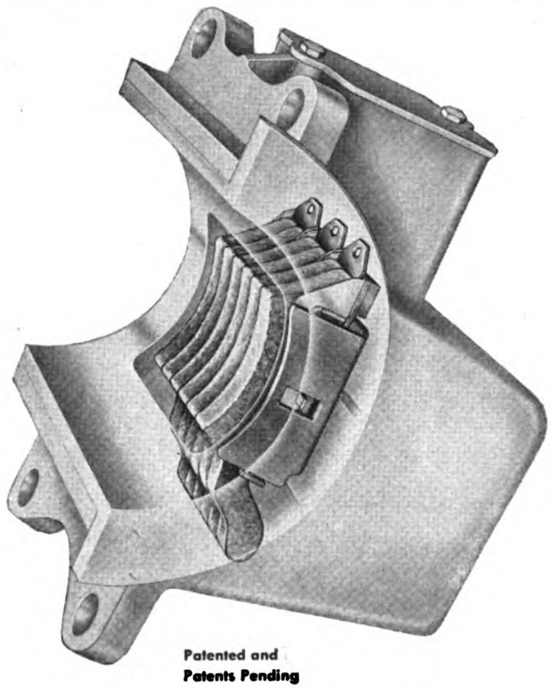
◆

FLINTKOTE COMPANY.—The Flintkote Company, New York, has appointed the *Ellcon Company*, 30 Church street, New York, as special manufacturer's sales representatives to the transportation industry for Flintkote products in the eastern section of the United States.

◆

SPRING PACKING CORPORATION—*George L. Green*, vice-president in charge of sales of the Spring Packing Corporation, has been elected executive vice-president, with headquarters in Chicago.





ELIMINATE *Costly* HAND PACKING...

Patented and Patents Pending

Convert your Old Fashioned yarn packed caps with... FELPAX *Lubricators*

It's Easy!!!

JUST 3 SIMPLE STEPS

1. Remove yarn pressure plate, (replace with mounting plate when necessary).
2. Fasten factory assembled Felpax carrier into place in axle cap.
3. Insert matched set of wicks.

Modern FELPAX Lubricators require only periodic checking and filling of the oil sump. You can cut maintenance labor to a minimum, eliminate costly waste grabs and starved bearings and reduce wheel change-outs due to excessive thrust wear.
FELPAX Lubricators give tens of thousands of miles of dependable lubrication on diesel traction motor suspension bearings. Lubricators may be completely reconditioned in the field with easy-to-install factory matched wick sets that are available at a nominal cost.

For Full Information about conversion to Modern FELPAX Lubricators see your locomotive builder or write to:



MILLER FELPAX CORPORATION
WINONA, MINNESOTA

Obituary

CHARLES W. T. STUART, president of the Safety Car Heating & Lighting Co., died October 1 in the United Hospital, Port Chester, N.Y. Mr. Stuart was 63 years old. He was born in Philadelphia and was a graduate of the Drexel Institute of Technology. He began his business career in 1908 with the Baldwin Locomotive Works and from 1909 to 1924 worked in the motive-power department of the Pennsylvania. In the latter year he joined Safety Car Heating & Lighting as a sales representative. He was appointed southeastern district manager in 1933 and also Philadelphia, manager of the Vapor Car Heating Company. Mr. Stuart was appointed assistant to the president of Safety in 1943, and was elected vice-president in charge of sales in 1946. He was elected executive vice-president in 1947 and president in 1948.

ARTHUR B. MCCOY, St. Louis representative for the steel floor division of the Great Lakes Steel Corporation, died on September 25 in St. Louis.

JOHN P. ROBERTS, assistant general manager of the Service Sales Division of the Timken Roller Bearing Company, was killed in an automobile accident near Spruce Pine, N.C., on September 19.

PERSONAL MENTION

General

G. J. FLANAGAN has been appointed assistant superintendent of equipment of the New York Central System, with headquarters at New York.

BRUCE C. GUNNELL, chief mechanical engineer of the Southern System at Washington, D. C., has been appointed acting superintendent motive power of the Eastern lines at Charlotte N. C.

(Continued on page 154)

...ineer of the division, first joined the ... in 1932. In July 1946 he resigned ... the chief engineer of the Storage Bat... division of Baker & Co., but rejoine... last July.

♦

...COTE COMPANY.—The Flintkote ... New York, has appointed the ...mpany, 30 Church street, New ...ecial manufacturer's sales repre... the transportation industry for ...oducts in the eastern section o... tates.

♦

...CKING CORPORATION—George ...-president in charge of sale... ...g Packing Corporation, Inc., ...xecutive vice-president, with ...n Chicago.

Obituary

...T. STUART, president of the ...eating & Lighting Co., chair... ... the United Hospital, Port... Mr. Stuart was 63 years ol... ... in Philadelphia and was ... the Drexel Institute of Tech... began his business career w... he Baldwin Locomotive Works ...09 to 1924 worked in the m... department of the Pennsylvania... ...er year he joined Safety Ca... Lighting as a sales representa... was appointed southeastern dis... ...ger in 1933 and also Philadelphia... ...of the Vapor Car Heating Com... Stuart was appointed assistan... ...e-sident of Safety in 1943, an... ...ted vice-president in charge ... 1946. He was elected executi... ...dent in 1947 and president...

...R B. MCCOY, St. Louis represent... ...he steel floor division of the Gree... ...el Corporation, died on Septem... ...n St. Louis.

...P. ROBERTS, assistant general ma... ...he Service Sales Division of the ... Roller Bearing Company, wa... ... an automobile accident ne... ...ine, N.C., on September 19...

PERSONAL MENTION

General

...ANAGAN has been appointed ... ...perintendent of equipment ... Central System, with headq... ...w York.

...C. GUNNELL, chief mechanic ... ...f the Southern System at Wa... ...C., has been appointed a ... ...ident motive power of the Easte... ...Charlotte, N. C.

Continued on page 154

UNITED STATES RUBBER COMPANY

LEADERSHIP

Developers and manufacturers of better electrical wires and cables for the railroad industry

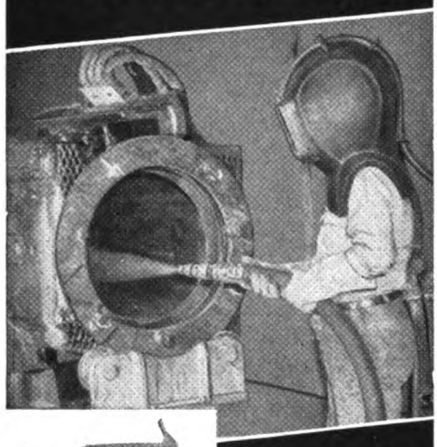
- **Railway Signal and Communication Cables** insulated with Laytex®— the insulation whose moisture resistance increases in wet locations.
- **Railway Power Cables of every description**
- **Royal Portable Cords and Cables**
- **Cab Wiring and Headlight Wire**

UNITED STATES RUBBER COMPANY

Electrical Wire and Cable Department

Rockefeller Center · New York 20, New York

CLEAN Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

(Continued from page 150)

JOHN C. STUMP, assistant chief mechanical officer, has been appointed chief mechanical officer of the Chicago & North Western, with headquarters at Chicago.

FRANCIS L. MORRISON, traveling electrical inspector for the Illinois Central, has been appointed general air-brake engineer, with headquarters at Chicago.

E. F. TUCK, master mechanic, Eastern division, St. Louis-San Francisco, at Springfield, Mo., has been appointed assistant superintendent of motive power. Mr. Tuck entered railroad service as an apprentice machinist in the Cleburne, Tex., shops of



E. F. Tuck

the Santa Fe. He came to the Frisco in 1922 as enginehouse foreman at Kansas City and later served as general foreman at Memphis, and in the west locomotive shops in Springfield. He was named master mechanic of the Eastern division in 1947

ANGELO J. PICHETTO, general air-brake engineer of the Illinois Central, has retired after 47 years of service with the railroad.

W. C. WARDWELL, assistant to general superintendent equipment of the New York Central System, has been appointed superintendent of equipment, with jurisdiction over the territory Buffalo and East and the Boston & Albany, with headquarters as before at New York.

GEORGE R. ANDERSEN, superintendent, car department of the Chicago & North Western has been appointed assistant chief mechanical officer with headquarters at Chicago.

R. F. BATCHMAN has been appointed assistant superintendent of equipment of the New York Central System with headquarters at New York. Mr. Batchman was formerly superintendent diesel shops of the B. & A. at West Springfield, Mass.

Diesel

J. A. WETZEL has been appointed superintendent of shop (diesel) of the New York Central at West Springfield, Mass.

M. B. ADAMS has been appointed assistant supervisor of diesel engines for the Atchison, Topeka & Santa Fe and the Panhandle & Santa Fe, with headquarters at Amarillo, Tex. Mr. Adams will have

it's Easy!

TO SERVICE YOUR AIR-Push WINDSHIELD WIPING EQUIPMENT WITH THIS NEW SERVICE CATALOG!



You can now quickly identify any wiper part by make and model of locomotive.

Here's a typical example:



Sprague Devices has specialized in the design and manufacture of dependable Air-Push windshield wipers for over 22 years. Today Air-Push is serving faithfully on over 85% of our modern diesel locomotives.

Send for the new AIR-PUSH Service Catalog Today . . . *its information will help keep your equipment operating at top efficiency.*

Sprague

DEVICES, INC.

Michigan City, Indiana

MANUFACTURERS OF THE FAMOUS AIR-Push WINDSHIELD WIPERS



This rebuilt locomotive cylinder head joint is "good as new." Many worn locomotive and car parts can be reclaimed at substantial savings.

5 *Cylinders for the price of 1*

What do you do when locomotive cylinder head seats wear down? You can buy new cylinders. Or you can ask OXWELD how to rebuild worn seats at about one-fifth the cost of new ones.

The high cost of living also applies to railroads. But with OXWELD'S methods, costly or scarce car and locomotive parts, such as this cylinder, can be repaired and returned to service at a fraction of the cost of a new part.

Here, four railroad welding operators build-up cylinder stud, flange, and head seat areas under the direction of an OXWELD service man. All of these areas are built up in 8 hours, including filling of stud holes. 300 lb. of OXWELD No. 25M bronze rod are used. Usually such reclamation is performed without removing the cylinders from the locomotive.

OXWELD RAILROAD SERVICE COMPANY, ROOM 1320
230 N. Michigan Avenue, Chicago 1, Illinois

Gentlemen:

Please send me booklet F-7371, "How the Oxy-Acetylene Flame Helps Railroads."

NAME_____

POSITION_____

RAILROAD_____

ADDRESS_____

Write for booklet F-7371 which contains useful information on making repairs. Use the handy coupon.

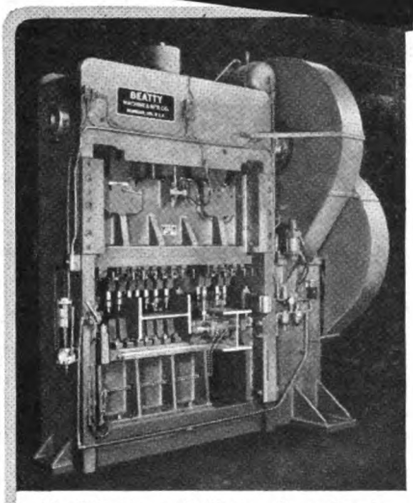
OXWELD RAILROAD SERVICE COMPANY
A Division of Union Carbide and Carbon Corporation
UCC
Carbide and Carbon Building Chicago and New York
In Canada:
Canadian Railroad Service Company, Limited, Toronto



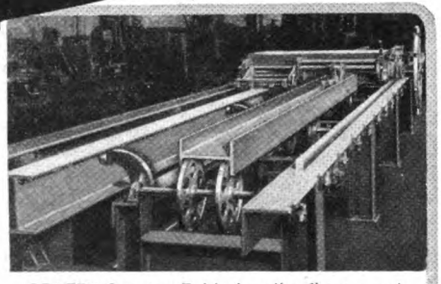
SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

The term "Oxweld" is a registered trade-mark of Union Carbide and Carbon Corporation.

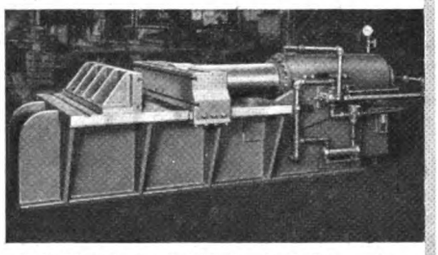
Five *ANSWERS* looking for a *PROBLEM*



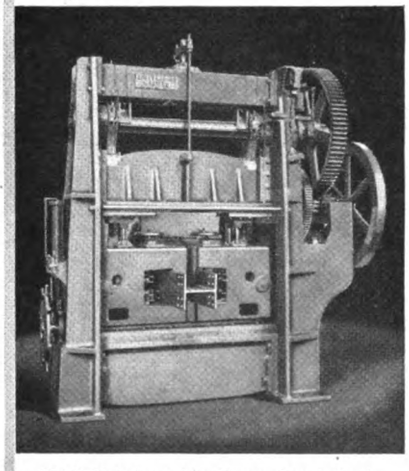
BEATTY No. 9 Guillotine Beam Punch for flange and web punching of beams up to 30". .



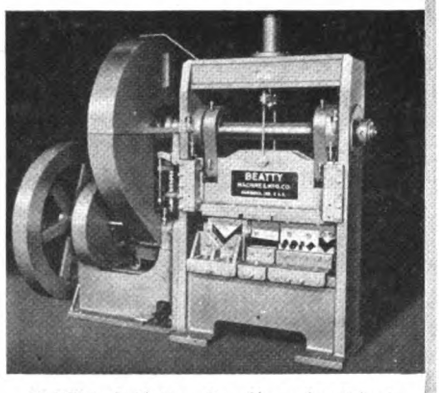
BEATTY Spacing Table handles flange and web punching of beams without roll adjustment.



BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.



BEATTY Adjustable Flange Punch Tools punch all 4 flanges of I-Beams and wide flange beams at one pass through.



BEATTY Guillotine Bar Shear for "short-order" shearing of flats, squares, rounds without changing tools.

BEATTY
Machine & Mfg. Co.
•
Hammond, Indiana

These five Beatty machines are speeding production, cutting costs in a lot of metal working plants. Perhaps one of these basic designs can be modified to meet your special needs. But if not there are more ideas where these came from. Let us know your problem and we will make a proposal. Our long and varied experience in machine design can be valuable to you.

jurisdiction over the Plains division of the P.&S.F. and the Panhandle division of the A.T.&S.F.

J. S. DUCK has been appointed diesel supervisor—system of the Illinois Central, with headquarters at Chicago.

Electrical

B. D. ALLISON has been appointed electrical engineer (fixed property) of the Chicago & North Western, with headquarters at Chicago. Mr. Allison will be in charge of the design, construction and maintenance of fixed property electrical power and light facilities.

L. E. LEGG has been appointed electrical engineer (equipment) of the Chicago & North Western, with headquarters at the Chicago shops.

Car

CLARENCE P. NELSON, general foreman of the Chicago & North Western, has been appointed assistant superintendent, car shops, at Chicago.

WALTER C. BARRER, assistant superintendent, car shops of the Chicago & North Western, has been appointed superintendent, car department, at Chicago.

Shop and Enginehouse

WALTER L. HUEBNER, master mechanic of the Atchison, Topeka & Santa Fe at Chicago, has been appointed superintendent of shops at Barstow, Calif.

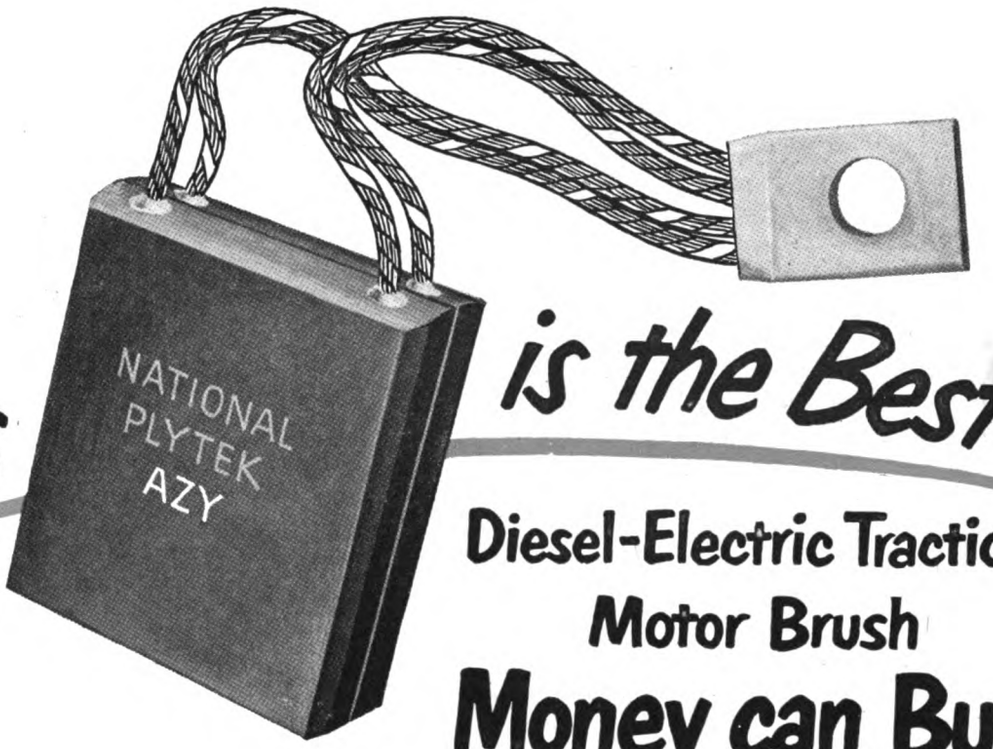
Master Mechanics and Road Foremen

DAVID BEATH, master mechanic of the Manitoba district of the Canadian Pacific at Winnipeg, Man., has retired. Mr. Beath entered the employ of the Canadian Pacific in 1901 at North Bay, Ont. Between 1937 and 1943 he was master mechanic at



D. Beath

Winnipeg, Moose Jaw, and Calgary. He served also at Kenora, Ont., as division master mechanic and became master mechanic of the Saskatchewan district at Moose Jaw in 1944. In 1947 he was transferred to Winnipeg.



This is the Best Diesel-Electric Traction Motor Brush Money can Buy!

Big Statement? You Bet!

BUT WE CAN BACK IT UP! Into the brush illustrated above, National Carbon Company has built plus factors which make it the finest in the world for its purpose — a brush developed especially for diesel-electric motors. Here's why:

- **"NATIONAL" Grade AZY**—proved by millions of service miles to give longest life with excellent commutator condition, plus remarkable freedom from breakage!
- **"NATIONAL" Permanently-Sealed Shunt Connections** do not pull out. Of millions made to date, *not one pull-out* has ever been reported! These Permanently-Sealed Connections also minimize cable fraying through special internal construction.
- **Exclusive Fray-resistant Cable** gives still further protection, with the result that overall brush dependability is assured!

All three outstanding features available in the following "NATIONAL" STANDARDIZED Brushes

NC 24-7215 — 2 x 2¼ x ¾" (⅜-⅜)
NC 24-5620 — 2 x 1¾ x ¾" (⅜-⅜)
NC 20-6420 — 2⅛ x 2 x ⅝" (5/16-5/16)

The terms "National" and "Plytek" and the Silver Strand Cable device are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
IN CANADA: National Carbon Limited
Montreal, Toronto, Winnipeg

protect
• passengers
• performance
• profits



LORD VIBRATION-CONTROL MOUNTINGS

LORD Vibration-Control Mountings are standard equipment on the new G. E. Diesel-Electric Undercar Power Plants. They insure pleasure and comfort by protecting passengers from disturbing engine noise and vibration. Performance is so efficient that passengers seldom realize that a power plant is operating beneath the car.

These LORD Mountings also protect the power plant from road shock . . . enabling it to operate smoothly and efficiently without interference. Instruments and automatic controls maintain original accuracy . . . require fewer adjustments . . . are more dependable . . . need less maintenance. Lower maintenance costs mean more profit to the operator.

If vibration is affecting your product's performance—and costing you sales—now is the time to investigate LORD Vibration-Control Mountings. For information, or for assistance in selecting and applying LORD Mountings, write to attention of Product and Sales Engineering Department.

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

Vibration-Control Mountings . . . Bonded-Rubber Parts

ARTHUR T. REYNOLDS, division master mechanic of the Canadian Pacific at Sudbury, Ont., has been transferred to Kenora, Ont.

J. F. COONEY has been appointed assistant master mechanic of the New York Central at Syracuse, N. Y.

R. CHRISTIE has been appointed division master mechanic of the Smiths Falls division of the Canadian Pacific at Smiths Falls, Ont.

H. W. ALLMAND, division master mechanic of the Smiths Falls division of the Canadian Pacific at Smiths Falls, Ont., has been transferred to the Laurentian division at Montreal.

R. J. PARSONS, master mechanic of the New York Central at Avis, Pa., has been transferred to Albany, N. Y.

J. J. RABY, who has been appointed master mechanic of the Manitoba district of the Canadian Pacific at Winnipeg, Man., as announced in the October issue, entered the employ of the Canadian Pacific at Fort William, Ont., in 1929. He was divi-



J. J. Raby

sion master mechanic at Regina, Sask., and Saskatoon, before his appointment as division master mechanic at Kenora, Ont., in 1950.

R. KLING, master mechanic of the Missouri Pacific at Nevada, Mo., now has jurisdiction over the Eastern, Joplin and White River divisions of the road.

VERNON L. MARLO, superintendent of shops of the Atchison, Topeka & Santa Fe at Barstow, Calif., has been appointed master mechanic at Argentine, Kan.

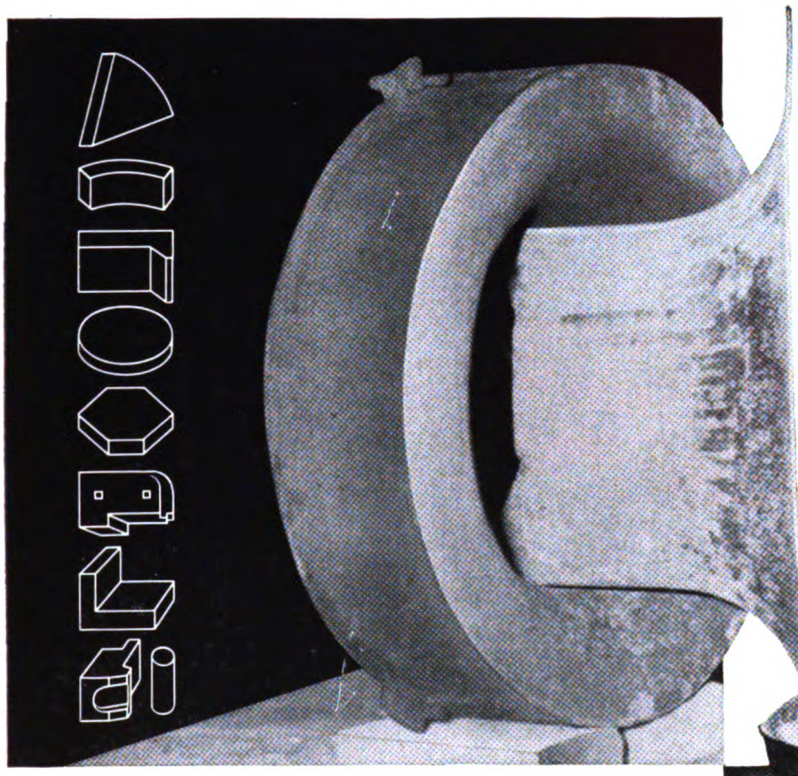
W. G. RINGLAND, assistant superintendent equipment, Buffalo and East, of the New York Central at New York, has been appointed master mechanic at Avis, Pa.

F. E. EDWARDS, superintendent electric equipment, Buffalo and East, of the New York Central, has been appointed master mechanic, with headquarters as before at Harmon, N. Y.

R. W. BALLARD, diesel supervisor—system of the Illinois Central, has been appointed master mechanic at Jackson, Tenn.

THOMAS MURRAY, master mechanic of the St. Louis-San Francisco at Tulsa, Okla., has been appointed master mechanic for

NOW... Get refractory shapes like this faster, at lower cost...





Photograph at left shows a boiler ring cast with 3X Firecrete. It is just one of many shapes that can be cast and fired in less than 24 hours with this hydraulic setting Johns-Manville refractory material.

Just mix, then cast. 3X Firecrete mixes and pours like concrete . . . is easy to handle.

. . . cast them yourself with 3X FIRECRETE



WITHIN 24 hours you can have ready for use any refractory shape you need—and save money as well—by casting it yourself with monolithic, hydraulic setting Johns-Manville 3X Firecrete*.

You'll find that Firecrete mixes and pours as easily as concrete . . . and hardens quickly with negligible drying and firing shrinkage. It has high resistance to spalling, too. And it is designed to withstand soaking temperatures of 3000F . . . to meet the high operating temperatures encountered in railroad service today.

Furnished in 100-pound bags for convenient handling and storage, 3X Firecrete is *available for immediate delivery.* Why not write us today for further information on how it can solve *your* refractory problem? Address Johns-Manville, Box 290, New York 16, N. Y.

*REG. U. S. PAT. OFF.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

93 YEARS OF SERVICE TO TRANSPORTATION

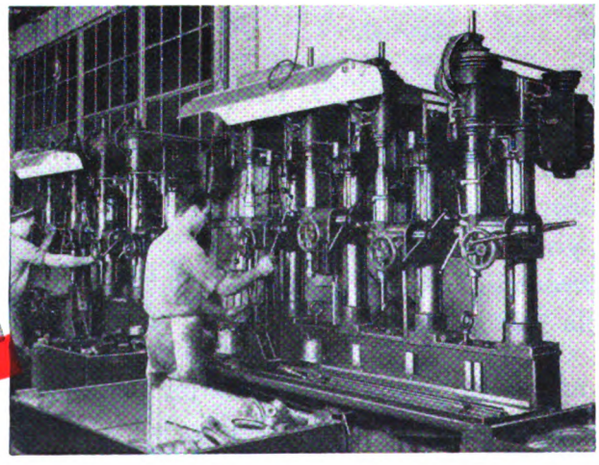


HOW THE AMERICAN METER COMPANY *Stepped Up* REGULATOR OUTPUT

"Buffalo" NO. 22 DRILLS

It takes a lot of accurate drilling, reaming and tapping to produce those high-quality regulators at the Erie Plant of the American Meter Company! Above, you can see how the problem has been handled—with single and multiple spindle "Buffalo" No. 22 Drills. Here a maximum number of operations are performed simultaneously, with minimum set-up time. Below, operator in foreground performs a tapping operation on a regulator with one of the four-spindle No. 22 Drills. Note the overall rugged construction (spindle diameter is 1.312", column diameter is 5.5"). Controls are easily reached. Let these accurate machines solve your drilling problem!





WRITE FOR BULLETIN 2989-F

BUFFALO FORGE COMPANY

174 Mortimer St. Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING CUTTING SHEARING BENDING

Southwestern and Western divisions, with headquarters at Tulsa.

U. F. TIHEN, master mechanic of the Missouri Pacific at St. Louis, now has jurisdiction over the St. Louis Terminal division (west side of river).

HAROLD MACKEY, master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed master mechanic at Chicago.

J. C. DIETRICH, master mechanic of the Missouri Pacific at Coffeeville, Kan., now has jurisdiction over the Southern, Kansas, Central and Wichita divisions.

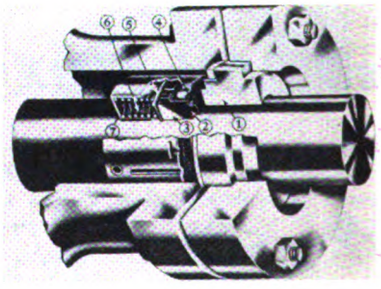
GEORGE M. JESSEE, general foreman of the west locomotive shops of the St. Louis-San Francisco at Springfield, Mo., has been appointed master mechanic at Tulsa, Okla.

R. H. SEAMON has been appointed assistant master mechanic, in charge of the west locomotive shop of the St. Louis-San Francisco at Springfield, Mo.

O. G. SUMNER has been appointed road foreman of engines, mechanical department, of the Norfolk Southern, with headquarters in Raleigh, N. C.

NEW DEVICES

(Continued from page 136)



High Temperature Mechanical Seal

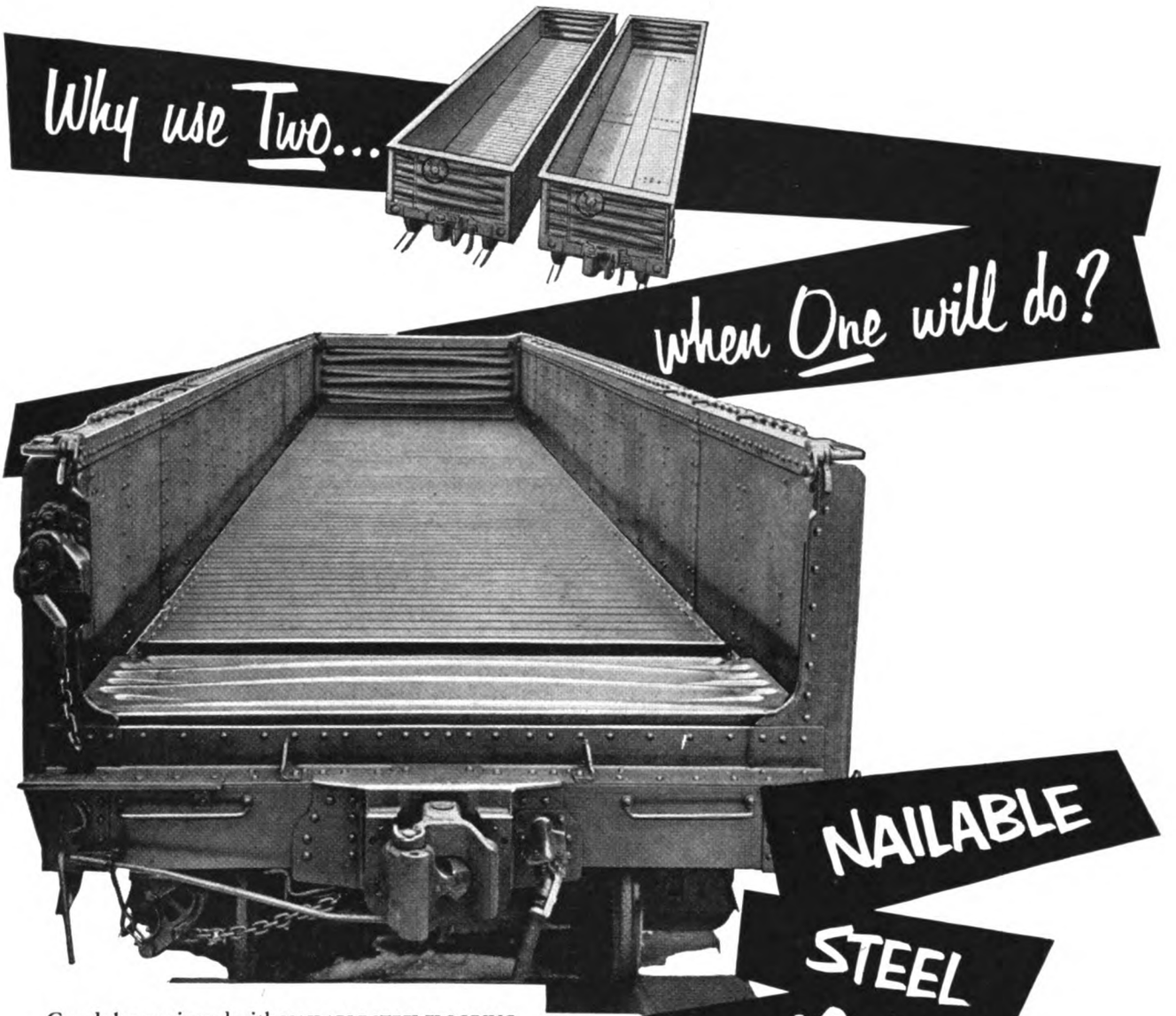
A new seal, designated as the type 9 Mechanical Shaft Seal, performs effectively under severe temperature and corrosive conditions.

This seal incorporates a flexible ring molded from the new plastic, Teflon. The "wedge-ring" enables this seal to combine the chemically-inert properties of Teflon with the flexibility and positive sealing components essential to effective mechanical sealing. It can be employed at temperature up to 500 deg. F. and was developed by the Crane Packing Co., Chicago 13.

The seal has been designed for service on various rotating shaft applications, such as centrifugal pumps, turbines, positive displacement pumps and agitators.

Construction of the seal is shown in the illustration: The set-screwed metal re-

Why use Two... when One will do?



NAILABLE STEEL FLOORING increases car supply with fewer cars!

Gondolas equipped with NAILABLE STEEL FLOORING do double duty because they are floored with steel . . . yet nailable. Without N-S-F, two types of gondolas are required to provide these features necessary to deliver rough freight and carry away open-top finished freight requiring blocking.

Made of N-A-X HIGH-TENSILE steel, N-S-F stands up under the roughest clamshell or magnet loading, yet takes nails easily, holds them tight, and provides an excellent surface for blocked or skidded loads.

Yes, N-S-F-equipped gondolas improve car supply with fewer cars. Shippers are served more quickly and efficiently-at less operating cost to the railroads.

PATENTS PENDING

N-S-F HOLDS BLOCKING BETTER — A GREAT LAKES STEEL PRODUCT

51-SF-10

NAILABLE STEEL FLOORS are formed of rigid N-A-X HIGH-TENSILE *steel channels, welded in place and separated by spacers to form nailing grooves. Stiff plastic composition in the grooves forms a tight seal.*

GREAT LAKES STEEL CORPORATION

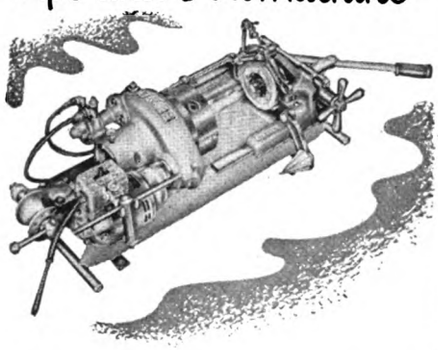
Steel Floor Division • Ecorse, Detroit 29, Mich.

PRODUCER OF N-A-X HIGH-TENSILE STEEL

NATIONAL STEEL CORPORATION

• LIGHTWEIGHT
• LOW-PRICED
• EASY-TO-MOVE

the New Beaver Model-E Pipe and Bolt Machine



The new low-priced, lightweight Beaver Model "E" is a "junior edition" of the heavy-duty Beaver Model A—which has, for the past 20 years, been the recognized leader in the field of portable pipe and bolt machines.

The Model "E" uses the same dieheads--the same dies—the same patented interchangeable wheel-and-roller or knife cutoff devices—the same reamer arm and cone—as the Models A and B. This will be a great advantage to thousands of shops now equipped with the Beaver Model A or B because it eliminates the necessity of carrying in stock duplicate dies and parts—thereby preventing endless confusion and needless expense. And remember, there are 195 different kinds and sizes of dies instantly available for Models A, B or E.

Although designed primarily for hardware stores and small piping contractors, BIG contractors will find the new Model "E" useful on jobs requiring extreme portability.

A pipe machine is no better than the service back of it and our 50 years of experience in this field, and our reputation for high quality and friendly service, is your best guarantee of complete satisfaction.

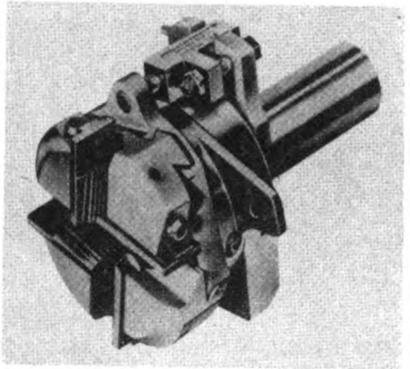
Price. $385.00 with quick-opening die head and ½" to 2" dies.
Stand (with 14" wheels) $20.00.
Write for new bulletin—"14 Outstanding Advantages."

BEAVER PIPE TOOLS

272-300 Dana Avenue • Warren, Ohio, U. S. A.

tainer (7) provides a drive from shaft to carbon sealing washer (2) through dents (4) which fit into washer notches. An effective seal between the shaft and washer is insured by the Teflon wedge ring (3) which is pre-loaded by the action of multiple springs (6). Spring pressure is distributed by a metal disc (5). The lapped raised face of the rotating sealing washer (2) mates against the lapped face of the stationary seat (1) to provide a leakproof seal with minimum running friction between the vertical faces.

◆



Die Heads

A line of die heads with ground thread tangent and radial chasers for high production class III threading with Brown & Sharpe automatics and small turret lathes has been announced by the Die Head Division, Jones & Lamson Machine Co., Springfield, Vt.

These chasers, ground all over, incorporate the exact helix angle and thread form. They are easily removed and replaced without disturbing the head and holder assembly.

Available in various models, the devices cover the complete B & S range from No. 0 to 1¼ maximum. Also, they are so arranged so that a single given die size will cover the capacity of a given B & S machine size.

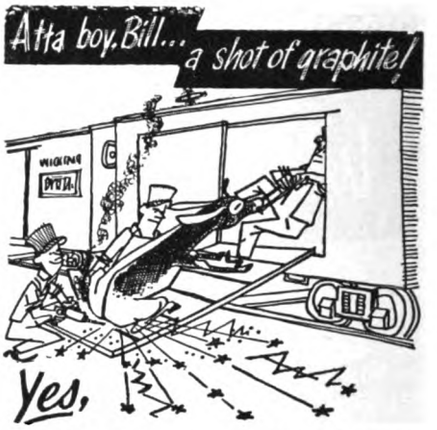
Features include both radial and tangent chasers mounted on the face of the die for free coolant flow and good chip clearance; special Dualife insert chasers for No. 00 machine dies, allowing turning over and using on the other side; two-thirds of this line, using tangent chasers, provides permanent throat feature; precision lapped and fit chaser holding blocks, and lever handle for use on small turret lathes.

◆

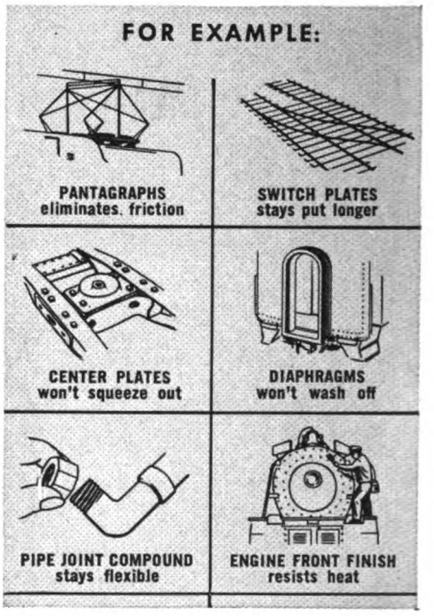
Phosphorescent Indicator Signs

Those responsible for the safety of employees consider the consequences of a power failure in a night-time emergency. Shelter and direction indicators must be seen in darkness as well as in light to insure safety.

Phosphor-Lite, a product development

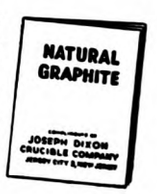


everything works better with Dixon Graphite!



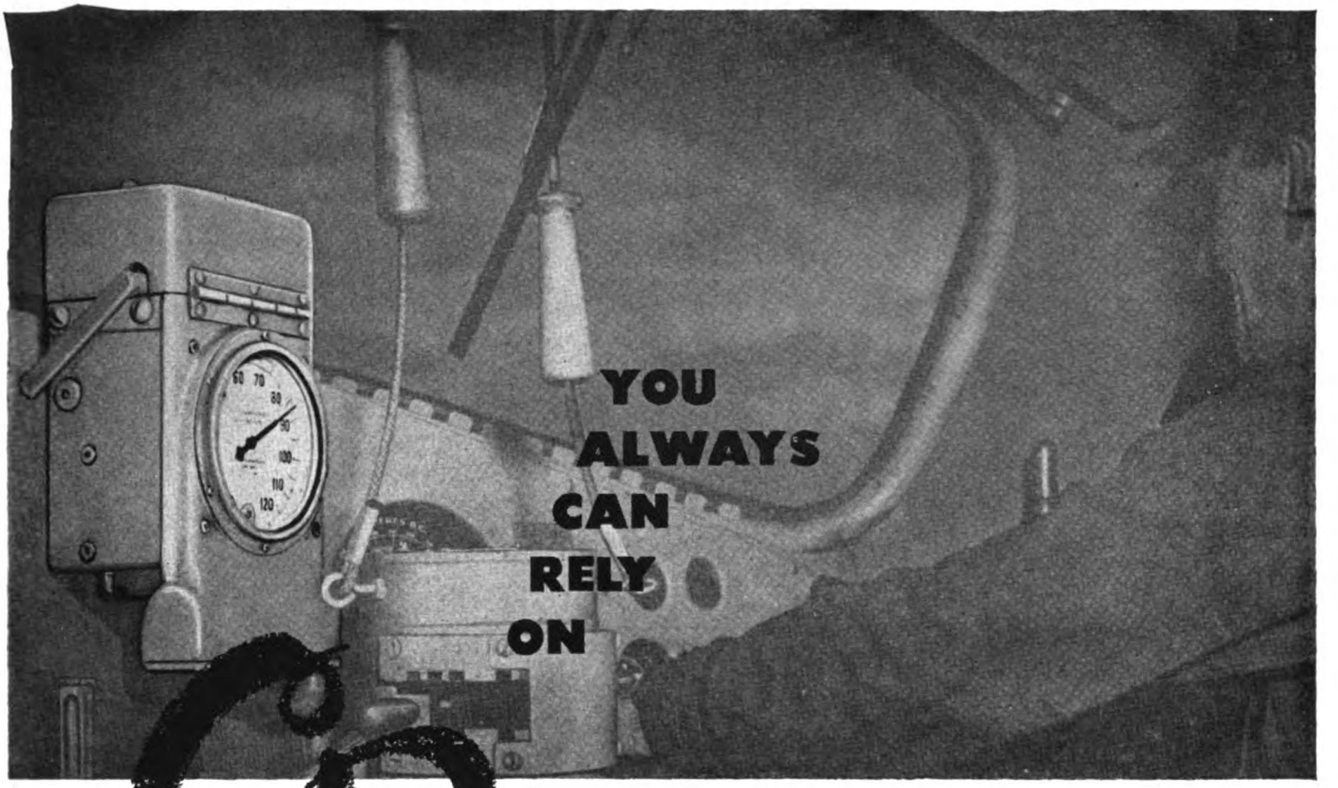
Use Dixon *Natural* Graphite for your TOUGH lubricating jobs! And what a job it will do for you! Rain and hosings won't wash it off – withstands extremes of heat and cold – won't squeeze out under pressure. Chemically inert, too. And doesn't pick up road dust or dirt.

SEND FOR FREE SAMPLE of Dixon 1924 – Quick Drying Lubricant. Try it – it's an effective, long lasting dry lubricant, superior to oil and grease for many applications. Also, ask for your copy of technical report "Natural Graphite." Joseph Dixon Crucible Company, Jersey City 3, N. J.

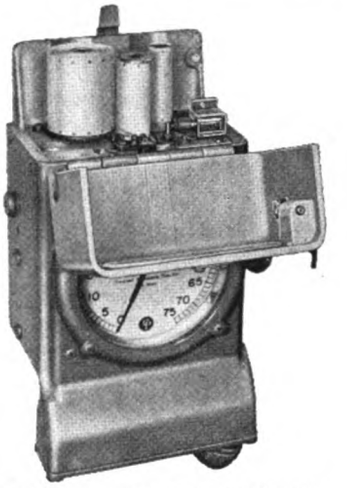


DIXON
NATURAL GRAPHITE

• 1924 Quick Drying Lubricant • Center Plate Lubricant • Graphite Seal • Pipe Joint Compound • Brake Cylinder Lubricant • Engine Front Finish • Graphite for Compounding • Lathe Center Lube



CP Speed Recorders



Top of Recorder opened to show recording tape.

for *accurate* records of all locomotive operations . . . Running Speed . . . Distance Traveled . . . Acceleration . . . Deceleration . . . Forward or Backward Movement . . . Slippage or Sliding of Wheels.

Available in two speed ranges: High Speed Recorder (CP-120-MR) for 10 to 120 miles an hour operation: Low Speed Recorder (CP-75-MR) for 0 to 75 miles an hour operation. Also furnished in kilometer models.

CP Speed Indicators, identical in construction with the Recorders, except for the recording mechanism, are also made in High and Low Speed models (CP-120-MI and CP-75-MI).

Write for Bulletin 841-2

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

of Norco Products Mfg. Co., New York 14, is a plastic that is coated with luminous materials that glow in the dark. It is rigid, non-inflammable, fire retarding and will not warp or curl. Backed with adhesive, they will adhere to almost any surface.

The device cannot be seen from the air, but is visible 15-20 ft. by the pedestrian public. It will glow for approximately 8-10 hr. after the activating light has been extinguished. Should the emergency arise where power is disrupted, the block letters of the sign will direct the way.

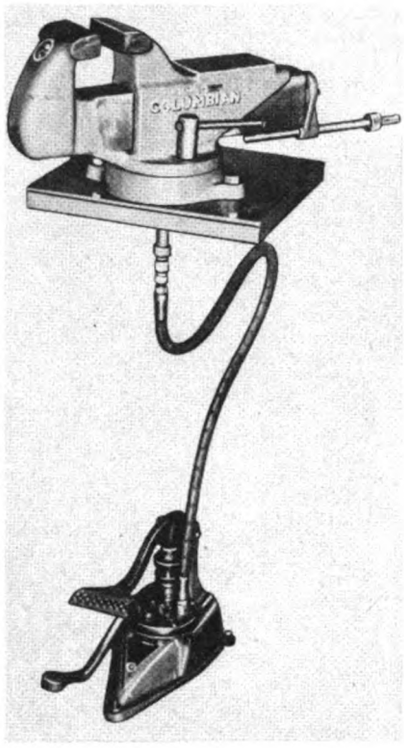
◆

Hydraulic Machinists' Vise

A new 4-in. jaw fast-operating hydraulic machinists' vise, known as No. 1004, is announced by the Columbian Vise & Mfg. Co., Cleveland.

This vise, which replaces the previous 3½-in. model, is substantially heavier (weighs 80 lb.) than previous models and has higher and wider jaws.

Maximum hydraulic pressure is 7,000 p.s.i. and maximum jaw pressure is 4,000 lb. A safety valve protects against overloading, and the jaws can be closed without damaging the lightest castings or finished surfaces. Vise closing speed is ⅞ in. per pump stroke. Full vise opening can be accomplished in 3 sec.



The hydraulic vise permits operators to use both hands to handle and position materials and in finishing work. The vise is controlled by two simple foot pedals—one for power, the other for release. Stop control is adjustable so that any production work is gripped and held with a single power stroke.

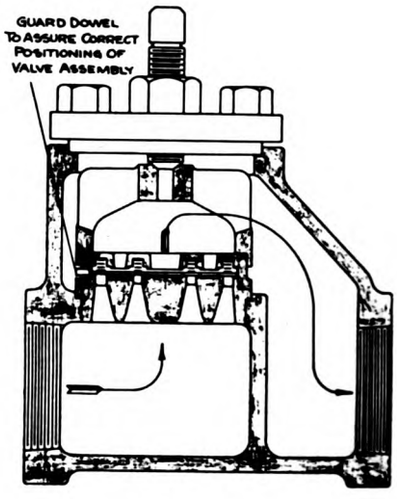
◆

Transformer Welder

Air Reduction Sales Company, New York, has announced a new 200-amp. transformer welder. Designated as Model MCM 200, the welder is designed for general maintenance and production welding. It has a full 200-amp., 50 per cent duty cycle, N.E.M.A. rating, and is available for 220/440/550-volt operation, with or without power factor correction.

Two open-circuit voltages are provided, —80 volts on the low range and 55 volts on the high range. This combines easy arc starting with a lower kva. demand load and primary ampere current. An easy-to-read current indicator affords quick adjustment of welding current. There are no moving parts.

◆



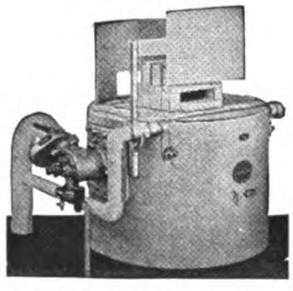
Discharge Line Compressor Valve

The function of a check valve in the discharge line of an air or gas compressor is to prevent leakage through the compressor during off cycle; to dampen pipe line pulsations; and to permit repairs to any unit where one or more than one compressor is on the line, without shutting down the entire system.

The PPC Aircheck Valve, introduced by the Pennsylvania Pump and Compressor Co., Easton, Pa. was designed to prevent compressor damage by safeguarding against forgetfulness of operating personnel to open a valve when starting up.

Installation of the device on discharge lines, according to the manufacturer, dispenses with customary arrangement of stop, safety and globe valves; prevents leakage of pressure through compressor during its off cycle and permits repairs without shutting down the system when more than one compressor is on the line.

Full Fire *INSTANTLY*
Without Smoke
...with a JOHNSTON



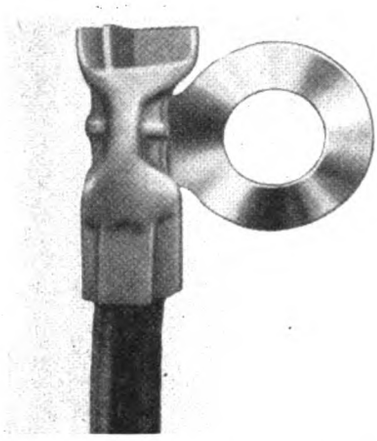
Oil Burning
BLACKSMITH FORGE!

SAVE TIME with a Johnston Blacksmith Forge! Eliminate costly lost time in handling coal and ashes. Parts are eaily and quickly positioned, and removed for inspection.

Increase production—lower costs with a new Johnston Oil Burning Blacksmith Forge!

ASK FOR CATALOG R 301
OVER THIRTY YEARS EXPERIENCE IN FURNACE DESIGN AND MANUFACTURE
BURNERS—BLOWERS—FURNACES—RIVET FORGES—
FIRE LIGHTERS—TIRE HEATERS

THE JOHNSTON LINE — SAFETY DEPENDABILITY
JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.
ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT



Solderless Flag Terminal

A flag type solderless terminal equipped with body insulation is now being made by Aircraft-Marine Products, Harrisburg, Pa. The terminal can be installed with one stroke of a tool on standard wires in ranges from No. 22 to No. 10. A color-coded plastic sleeve of high dielectric qualities is bonded to a thin copper sleeve which is attached to the terminal barrel. The bomb-tail end is formed under optimum temperatures and pressures to make an intimate seal. The terminal is crimped to the wire by placing it end-on in a special tool so that the entire body is confined during the crimping cycle, and therefore the plastic sheath does not wrinkle or warp away from the terminal tongue.

Pre-insulated flag terminals can be used to advantage wherever space is at a minimum, or where a flag terminal is customarily used with separate tape or insulation tubing.

◆

Self-Emulsifying Cleaning Solvent

A solvent named Gunk and possessing high grease cleaning and carbon removing properties for the purpose of cleaning carburetors, fuel pumps, diesel injectors, pistons, oil strainers and metal parts has been introduced by the Curran Ordnance Chemical Laboratory. Lawrence, Mass. The product is described as a di-phase solvent and comprises a water emulsion floating top layer sealing a volatile chloraromatic solvent lower layer.

Performance of this di-phase solvent is substantially faster and will produce more complete and quicker results than can be obtained from present chlorinated type vapor degreasing solvents. Where chlorinated solvents can no longer be obtained because of critical shortages, this solvent may be used as a replacement in the present solvent distilling cleaning tanks.

WIEDEKE · DAYTON
IDEAL
TUBE EXPANDERS

For Faster, Smoother Tube Rolling

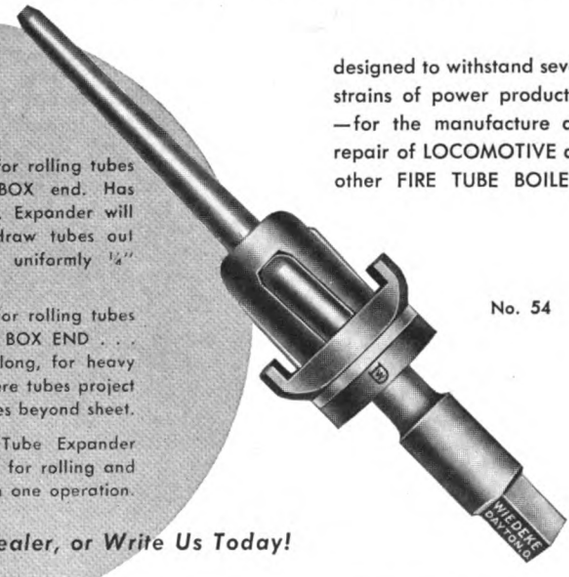
IDEAL MASTER Tube Expanders

designed to withstand severe strains of power production —for the manufacture and repair of LOCOMOTIVE and other FIRE TUBE BOILERS.

No. 54-S . . . for rolling tubes in the FIRE BOX end. Has rolls 1¼" long. Expander will automatically draw tubes out against guard uniformly ¼" for beading.

No. 54-L . . . for rolling tubes in the SMOKE BOX END . . . has rolls 1⅞" long, for heavy sheets and where tubes project various distances beyond sheet.

Similar Ideal Tube Expander (No. 60) made for rolling and flaring tubes in one operation.



No. 54

See Your Dealer, or Write Us Today!

THE GUSTAV WIEDEKE COMPANY
DAYTON 1, OHIO

IPM

ENDS COSTLY SHUT-DOWNS of motors and generators



IDEAL PREVENTIVE MAINTENANCE

protects you against shut-downs and high cost overhauls resulting from commutator and slip ring failure. IPM keeps motors and generators at peak efficiency . . . *without dismantling,* and with only simple, routine maintenance. It insures you of using the methods and equipment that have proved most practical and economical in eliminating commonly encountered commutator and slip ring troubles. IPM has improved operating dependability and efficiency—*and reduced costs*—at many of the nation's largest users of electric motors and generators. It can do as much for you!

Get this FREE handbook of practical help!



procedures and methods developed by independent authorities on commutator and slip ring maintenance. What to do and how to do it!

Forty pages, profusely illustrated.

MAIL COUPON TODAY

IDEAL INDUSTRIES, Inc.
1563 Park Avenue, Sycamore, Ill.

Please send your free maintenance handbook and further information on:

☐ Flexible Abrasive ☐ Resurfacers
☐ Precision Grinders ☐ Undercutters
☐ Commutator Cleaners ☐ Other Tools

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE____

Its top water-emulsion seal prevents direct contact with skin, such as dipping the hands or splashing the active lower layer solvent directly into the eyes. The solvent is also said to be fireproofed by reason for its top water emulsion seal. In addition, both phases are completely water soluble and in event of a sprinkler protected building, the solvent will simply rinse away as a solution of liquid.

◆

Anchorlite

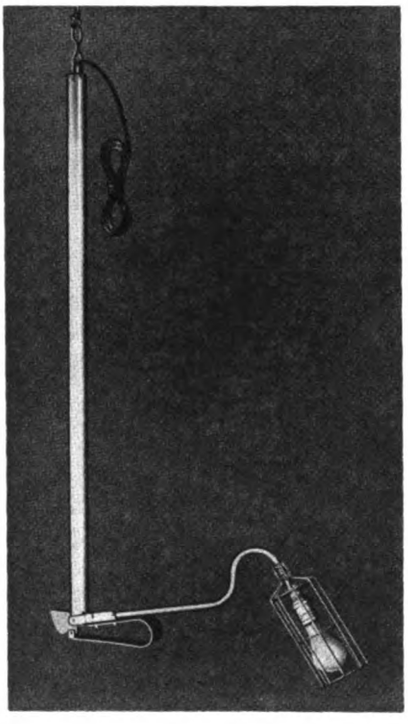
An overhead suspension, interior illuminator for installation on loading platforms for loading freight cars, trucks or trailers, called Anchorlite, has been developed by the Pyle-National Company, 1334 N. Kostner avenue, Chicago. The light is designed to fill the need for a convenient, economical source of the good lighting required, temporarily, inside freight cars, trucks and trailers while at loading platforms. It is also for use in lighting the underside of equipment in locomotive and car shops, and in warehouses and stock rooms for lower bin lighting.

When installed as shown, it is always available for immediate use, yet overhead and out of the way. No time is lost finding extension cords and plug-in outlets, untangling cords, or finding or improvising support for hand lamps. Also, it avoids portable light cord damage from constant handling, dragging, and kinking, minimizes lamp breakage and eliminates theft of portable cords. It is grounded to its support, reducing shock hazards and short circuits. There are no cords to trip over.

The Anchorlite is designed to swing free on a swivel when suspended on a stationary bracket at a truck or trailer loading dock. A spring-loaded telescopic anchoring device provides up to three feet of expansion in length, with a firm supporting tension. The lightweight anchoring arm is easily pulled downward with a cord or hook and placed in the top of the car doorway, where it will support itself and not interfere with loading operations.

In a freight house installation, the Anchorlite is designed to be suspended from a messenger wire on which it can slide the full length of a loading platform bay, to any position where the freight car door may be spotted on the track.





◆

Battery-Powered Dispense For Heavy Lubricants

The Brown Dynalube Manufacturing Company, Charlotte, N. C., has developed a portable, battery-powered dispenser for the heavy, tar-like lubricants used in the traction-drive gear cases of diesel-electric locomotives. In most shops these lubricants have been handled entirely by hand.

The dispenser, called Dynalubricator GHM-3, has a capacity of 150 lb. of lubricant. The lubricant container, lubricant hose compartment and the pump are surrounded by a Fiberglas insulated water jacket. Two 220-volt, single-phase a.c. 1,000-watt, immersion type, thermostatically controlled heating units heat the lubricant to a working temperature, usually 160 to 170 deg. F., before the lubricant is pumped into the gear cases. Once up to heat, the lubricant will remain at a working temperature for about 8 hr. or more.

A metering lube gage built into the Dynalubricator accurately measures the lubricant pumped in each operation so that any amount up to 12 lb. can be pumped into each gear case. The amount to be pumped can be adjusted in a few minutes, with only a pair of pliers. This makes possible putting exactly the same amount of lubricant into each gear case. Two pounds of lubricant is pumped in 11 sec.; four pounds, in 22 sec., etc.

The lubricant hose is 15 ft. long and is fitted with a drip-proof nozzle. The pump will not run until the lube gage has been reset and the nozzle is fully opened. A safety switch on the hand control automatically starts the pump when the nozzle is opened. The lube gage cuts the motor off when the set amount has been pumped.

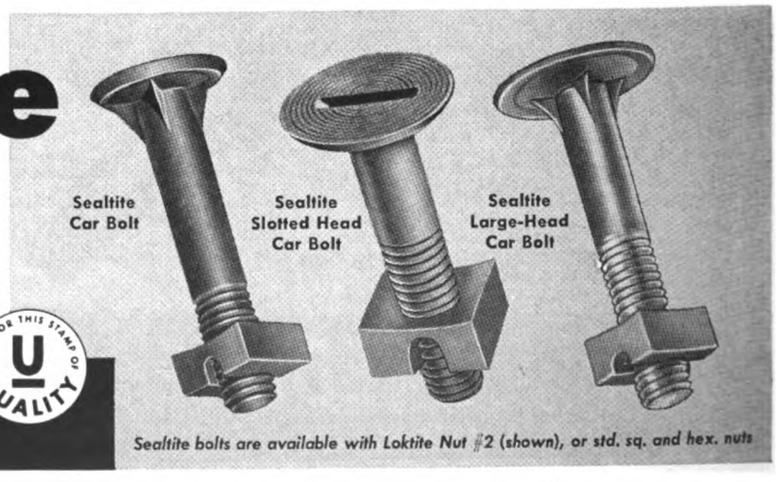
The Dynalubricator is mounted on rubber tires and is easily moved about and operated by one man.

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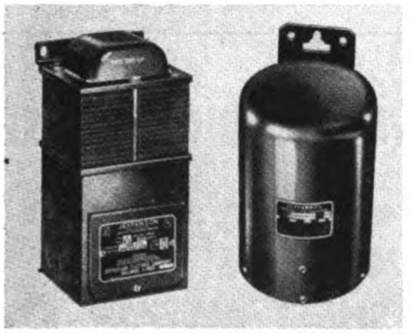


Sealtite bolts are available with Loktite Nut #2 (shown), or std. sq. and hex. nuts



The unit's drop cord is plugged into a 220-volt, single-phase a.c. outlet during the lubricant heating period but this line is disconnected before the pump is started. The pump is powered by a 19 plate, 6 volt storage battery. A self-contained battery charger recharges the battery during the heating period. The battery has sufficient power to pump more than 300 lb. of lubricant. Battery power gives the Dynalubricator complete freedom from power outlets and dangerous voltages during operation.

◆



Transformers for Mercury Vapor Lamps

A revised line of transformers for operation of mercury vapor (H-1) lamps is announced by the Jefferson Electric Company, Bellwood, Ill. These include indoor and outdoor types. The line of indoor transformers consists of single and two-lamp units,—normal and high power factor,—available for 115- and 230-volt circuits, equipped with roomy wiring compartments having ½-in. and ¾-in. knockouts. Several primary voltage taps are provided to permit close matching of the transformer to the line voltage. The line of outdoor transformers lists aerial, pole top, pole base and vault types for building exterior lighting and parking and shipping area illumination. The transformers are designed and manufactured to meet the specifications of the leading manufacturers of mercury vapor lamps. The accompanying illustrations show a representative indoor and outdoor transformer.

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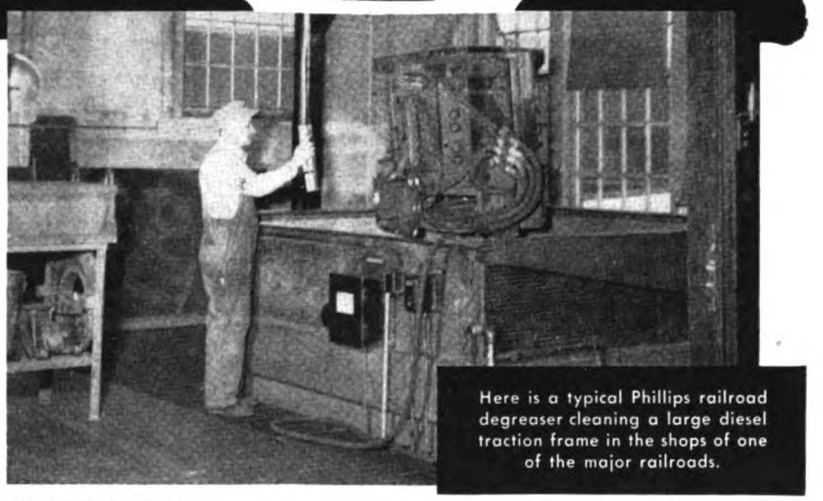
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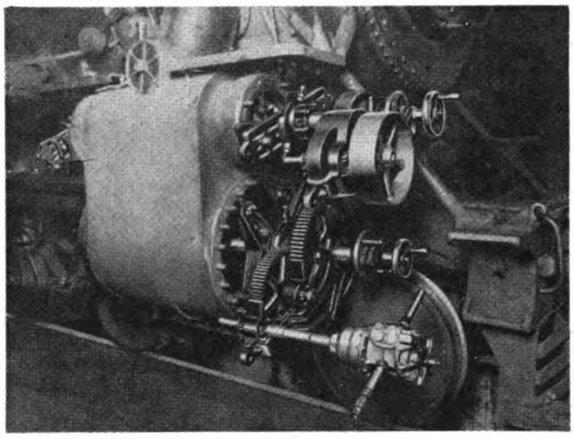
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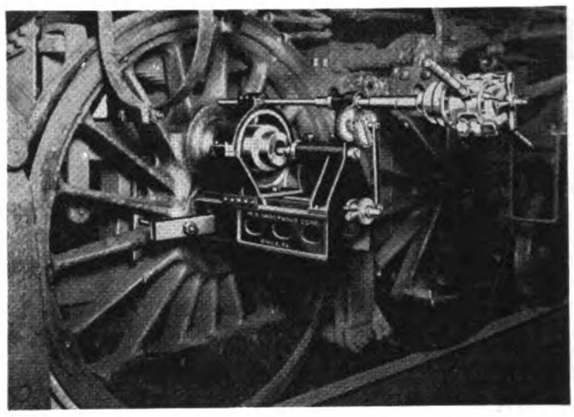
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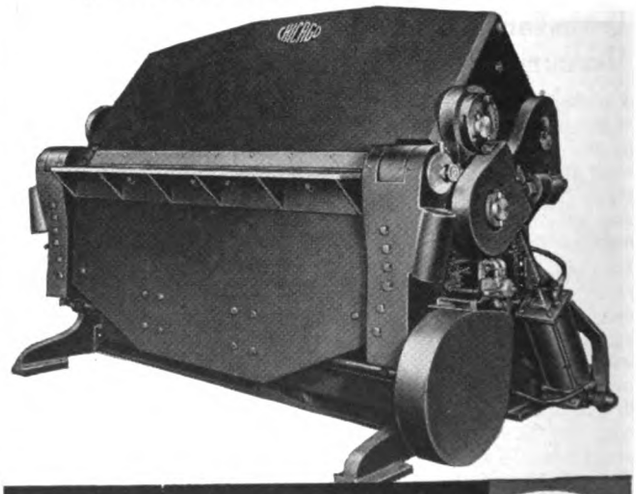
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DECEMBER, 1951

VOLUME 125

No. 12

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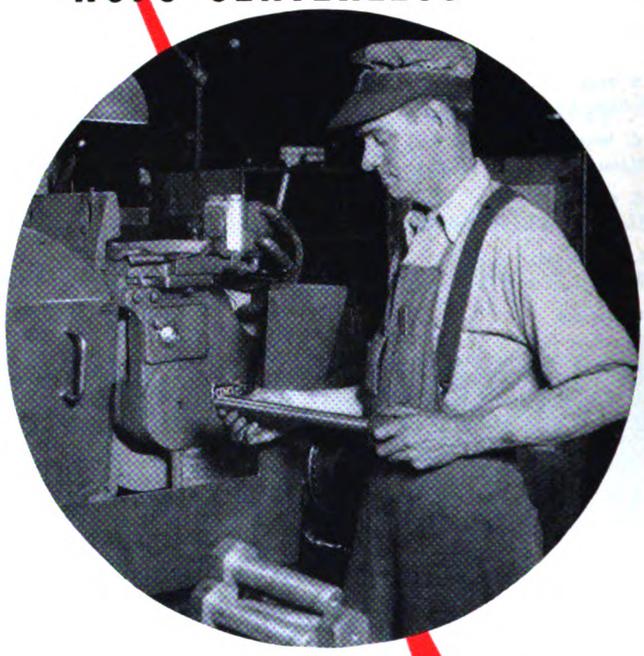
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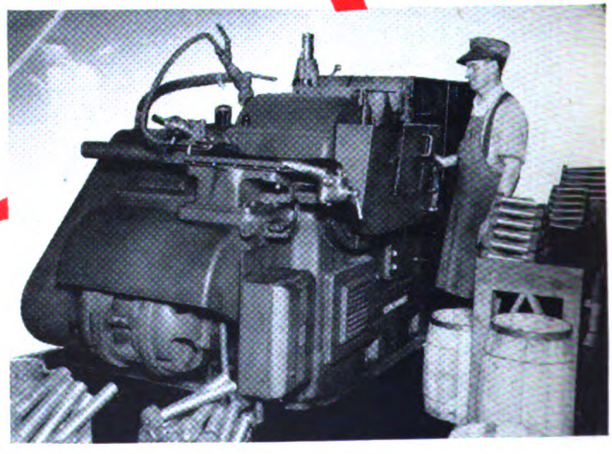
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RAILWAY Mechanical and Electrical Engineer



The situation at the Argentine roundhouse on the afternoon of July 14

Restoring Flood-Damaged Equipment*

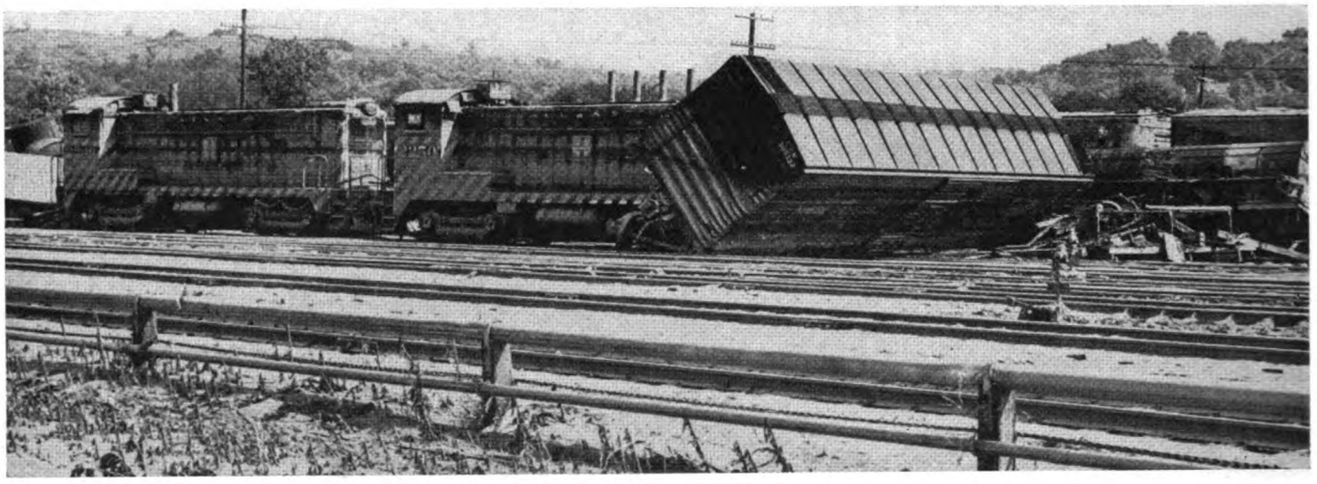
APPROXIMATELY 5,500 freight cars, 21 steam locomotives and 51 diesel locomotive units were involved in the July flood at Kansas City (Argentine), Kan., the Atchison, Topeka & Santa Fe restored this equipment to service in a little over a month. The diesel units were reconditioned in Santa Fe system shops in 17 working days.

A flood similar to that of July 13, 1951, was experienced on the Santa Fe in 1903 when the Kansas or Kaw river overflowed its banks and discharged an estimated 262,000 cu ft. of water per second downstream, as compared with 500,000 cu. ft. in the latest catastrophe. The maximum depth of water last July was about 22 ft. in the Argentine enginehouse and 26 ft. on the car repair tracks.

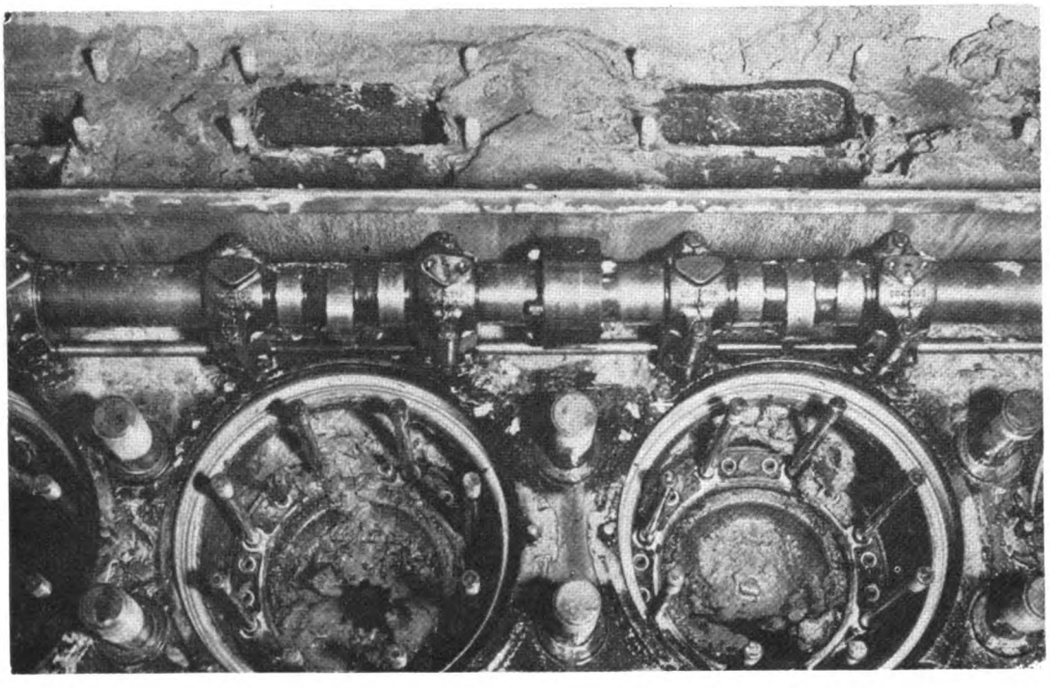
The railroad was advised that protective dikes would hold and therefore cars and locomotives were not moved out of that vicinity, although as many locomotives as possible and some wrecker equipment were placed on the hump—just in case. When the flood reached its peak, only about 700 ft. of the crest of the hump remained clear of water.

Another precaution taken by the Santa Fe was to remove electric motors from shop machines at Argentine and place them on top of steam locomotive tenders for protection, with the thought that water would not get that high and the motors would be safe. But when the

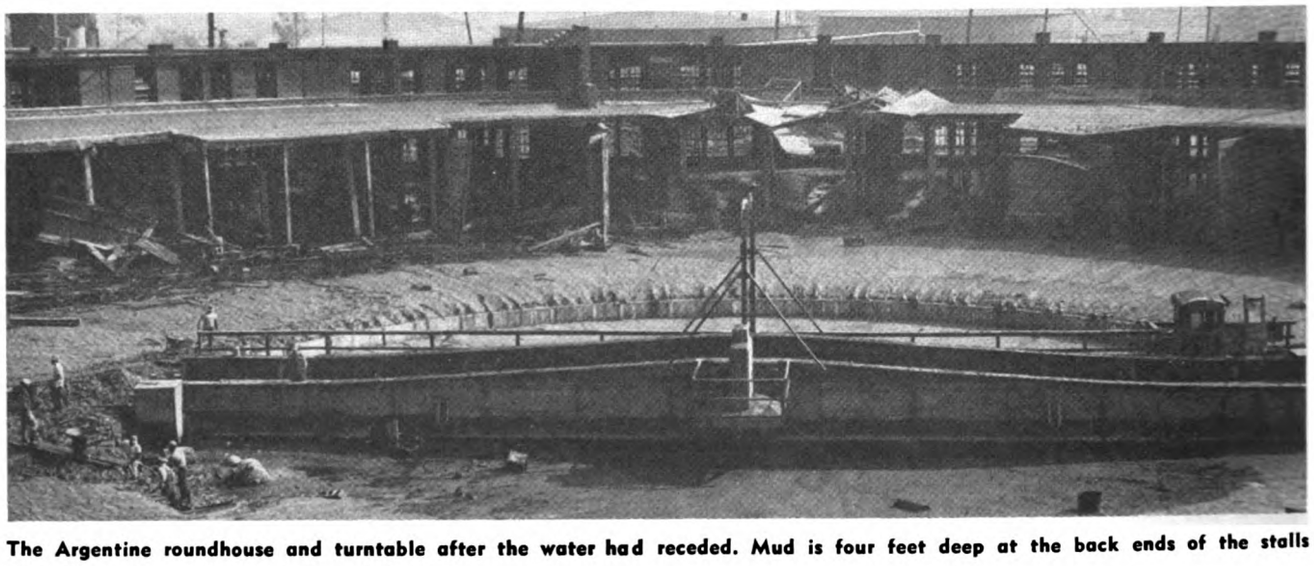
* This article is based on information supplied by John Morris, general manager, mechanical, Atchison, Topeka & Santa Fe, in addressing the annual meeting of the Locomotive Maintenance Officers' Association at Chicago on September 19. Facts about the drying out of electrical equipment were presented by L. L. Luthey, general supervisor of diesel engines, at the same meeting.



These diesel locomotives were completely submerged



Mud penetrated to the innermost recesses of the diesel engines and electrical generators and motors



The Argentine roundhouse and turntable after the water had receded. Mud is four feet deep at the back ends of the stalls

water reached maximum depth in the enginehouse it covered the locomotive tenders and these motors were rendered inoperative. At one point, five or six steam locomotives were placed on a Santa Fe bridge to help hold it down, a procedure which worked well in the 1903 flood, but in this instance one of the bridge spans failed and three of the locomotives were lost.

In addition to the affected motive power, 5,500 empty and loaded freight cars were wholly or partially submerged for six days. About 650 of these were derailed; many empty car bodies floated away and some came to rest on top of other equipment. Attendant wrecking and reconditioning is neither easily imagined nor described.

How debris and silt up to four feet deep were removed from Santa Fe facilities at Argentine after the water receded is a story in itself. This task occupied the full efforts of about 700 men, fully supplied with bulldozers, high-lifts, trucks and other mechanical equipment and working around the clock for nearly three weeks. No authentic estimate is available of how many thousand truck loads of mud were hauled away.

About the first requirement was to get compressed air and water for cleaning and testing purposes. In the emergency, electric power was supplied from an outside source to operate portable motor-driven equipment and lights. Gas-engine-driven water pumps were utilized and railroad power plant was put in shape to afford fire protection about three days after cleaning operations began.

One bad condition which delayed operations considerably was the fact that several low spots in the enginehouse and car shop area could not drain properly and held not only water but fuel oil and the vapors of high-test gasoline escaping from ruptured tanks in the vicinity. This condition constituted a veritable tinder box, to such an extent that it was unsafe to use any open lights or operate either engine-driven equipment or electric motors nearby.

In the organized rehabilitation program which was adopted, the initial objective was to get cars moving so as to allow space for switching and the re-establishment of service. In clearing yard tracks, the Santa Fe used all types of wrecking equipment, working some 14 wrecking crews on a 24-hour basis, and sometimes rerailing as many as 65 cars in a 24-hour period. These were cars simply off the rails, but some were wedged in the debris and the bodies of others had floated away. It was a herculean task to move these bodies and trucks to a point where they could be reassembled and rerailed.

In order to recondition journal boxes and air-brake equipment, cars were removed from the adjacent yard to repair tracks and, of course, in this movement with only mud for lubrication, bearings squealed and generally were damaged. In reconditioning the bearings, mud and debris were removed from the boxes, brasses and wedges taken out, journals cleaned and inspected, hollow axles flushed out, cleaned or new brasses and wedges applied as required, boxes repacked with new waste and oil and retainer springs applied to all boxes, whether foreign or system cars. The Santa Fe undertook this additional expense on foreign-line equipment in order to prevent insofar as possible the development of any hot boxes in moving the cars to destination. Foreign lines were not billed for repacking, nor were cars stencilled after the journal boxes had been repacked.

In packing boxes, car department forces used hydraulic journal jacks and worked full crews of men around the clock, repacking boxes on about 350 cars a day. The railroad gives full credit not only to personnel but to labor-saving devices and tools, including these hydraulic jacks, which are said to have paid for themselves many times over in the emergency.

Car bodies which floated away from the trucks were seriously damaged, particularly the running boards of tank cars, safety appliances, etc., and repairs could not be made at Argentine yard on account of flood conditions. These cars were reassembled and moved to shops at Topeka, Kan., about 60 miles, in bad-order trains for necessary repairs.

Box cars and refrigerator cars which had from two to three feet of mud in them were moved to Wellington, Kan., and West Wichita, Kan., for cleaning and reconditioning.

Air brakes were given close attention, AB valves being removed and replaced with serviceable equipment to the fullest extent practicable. On some cars, the emergency and service portions were removed and cleaned thoroughly. Water drained from air brake equipment and piping varied in amount from one to ten gallons. The Santa Fe did not bill foreign lines for cleaning air brakes, but performed this work on all cars regardless of ownership, doing the best job possible under very demoralizing conditions.

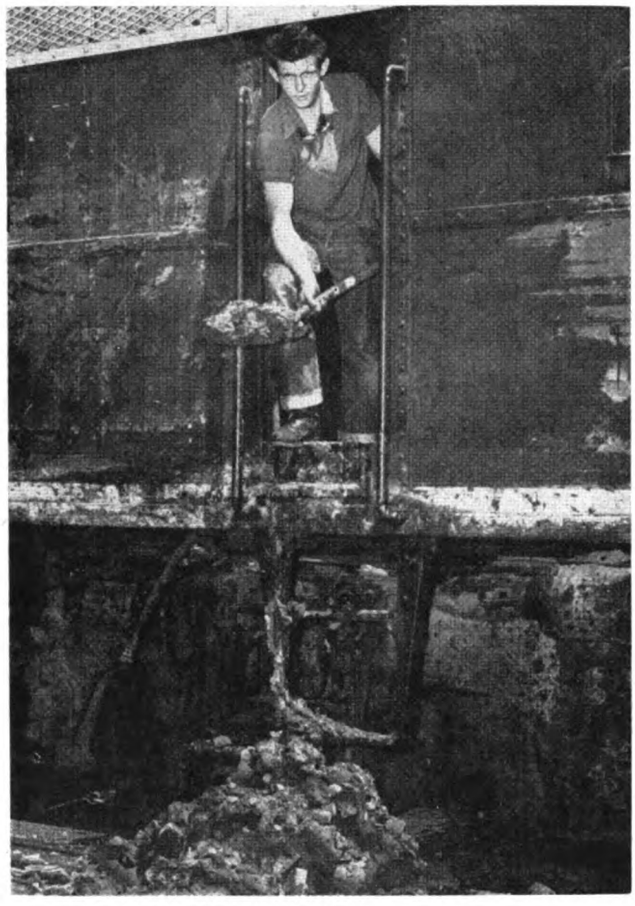
In reconditioning motive power, both steam and diesel, the Santa Fe reports that old steam locomotives did not need as much attention as the diesels. On steam locomotives, about the biggest job was to remove the cylinder heads and valves and thoroughly wash out the valve chambers and cylinders. It was found by close inspection that both roller bearings and plain bearings on steam power were relatively undamaged, but a large number of roller bearings in stock were covered with water and badly pitted.

The damage to diesel motive power at Argentine has been described as devastating. The 51 units involved were sent to various shops on the system in order to recondition them as quickly as possible. The distribution was as follows: 18 units to San Bernardino, Cal.; 15 to Cleburne, Tex.; 13 to Topeka, Kan.; three to Fort Madison, Iowa; to units reconditioned at Argentine. Shop forces were put on three shifts so that repairs could be made around the clock.

This vast amount of work included: removing engines from the chassis of switchers; removing engines from the power plants of road-type power; dismantling all engines, cleaning them out thoroughly and putting in new pistons and rings or bearings, depending on what was required; removing main generators and traction motors, for drying out, including high-voltage wires in the power plants. Fortunately only about ten traction motors failed to pass the required tests after being cleaned and dried out. Only one main generator out of the entire lot could not be returned to service after drying.

The first difficulty encountered was preparing the diesel units for movement to distant repair shops, it being necessary to wash and repack suspension and axle-journal bearings, lubricate armature bearings and force out as much water as possible. Mud and silt which filled the gear-case boxes had forced out the crater compound. Debris was packed inside the traction motors, to such an extent that fire hoses were used for several hours on each unit washing out the motors to permit rotation of armatures without further damage. In some cases it was necessary to shovel away mud in order to get at the traction motor inspection covers.

Some difficulty was experienced with the movement of these locomotives, especially switchers with plain journals, as a result of pitting. Excessive damage oc-



Misplaced Kansas soil

curred to the control equipment, wire shunts, coils, terminals, voltage regulators, load regulators, control panels, contactors, etc. The majority of this equipment had to be completely dismantled, cleaned, baked and reassembled. In addition to this overhauling and efforts to reclaim this material, it was necessary to renew a large percentage of operating coils, voltmeters and ammeters, push-button switches, fuse clips, relays, resistors and contacts. Although these appliances appeared to be dried and checked satisfactorily, after the work was completed, many developed open circuits several days later. This damage is believed to be a result of electrolysis and the formation of verdigris.

Washing down electrical cabinets and equipment as soon as possible and spraying with a petroleum base cleaner or oil tends to reduce corrosion. Exposed wiring painted with insulating paint experienced little damage. Exposed varnished cambric wire cable suffered severe damage in many cases. No defects were found with the neoprene-type wire cable, indicating the ability of this type of cable to withstand submersion without deterioration.

Main generators, traction motors, auxiliary generators and motors after being dismantled were thoroughly washed down before drying. Attempts were made to use a large dry kiln, also a heat-treating furnace, for drying traction motors and main generators, but each proved unsuccessful. Reasons included inability to obtain sufficient temperature in the dry kiln; lack of automatic controls on the heat-treating furnaces to maintain a constant temperature, requiring armatures to be placed in a tightly-closed pit at approximately 300 deg. F. and allowed to cool; and inability to carry off moisture fast enough in the heating and drying operation.

Steam heaters with forced-air blowers and infrared lamps were used on main generators in place and found to be inadequate. Nor was it possible to clean generators properly and the pitting condition of armature bearings necessitated dismantling all generators and motors.

The armatures of four main generators were short circuited in endeavoring to use the internal drying method. One armature was damaged, two generators meggered zero after approximately three days running and were then removed from the locomotive. One generator was actually returned to service by this method.

Extensive use of infrared lamps was helpful for both frames and armatures but necessitated three to four days drying, and it was impossible in most cases even then to secure a satisfactory insulation test. This led to further experiments resulting in the adoption of gas-fired annealing furnaces, equipped with temperature-recording instruments. By operating full blower and pilot lights as needed to maintain a temperature between 275 and 300 deg. F., it was found possible to dry two main generators and eight traction motors simultaneously in 18 to 36 hours.

Care was exercised with commutators which would not readily dry out, as overheating would have caused them to rupture. On most main-generator and traction-motor commutators, it was necessary to remove one commutator V-ring bolt and siphon out water trapped within the commutator and at the same time allow steam to escape during the drying process.

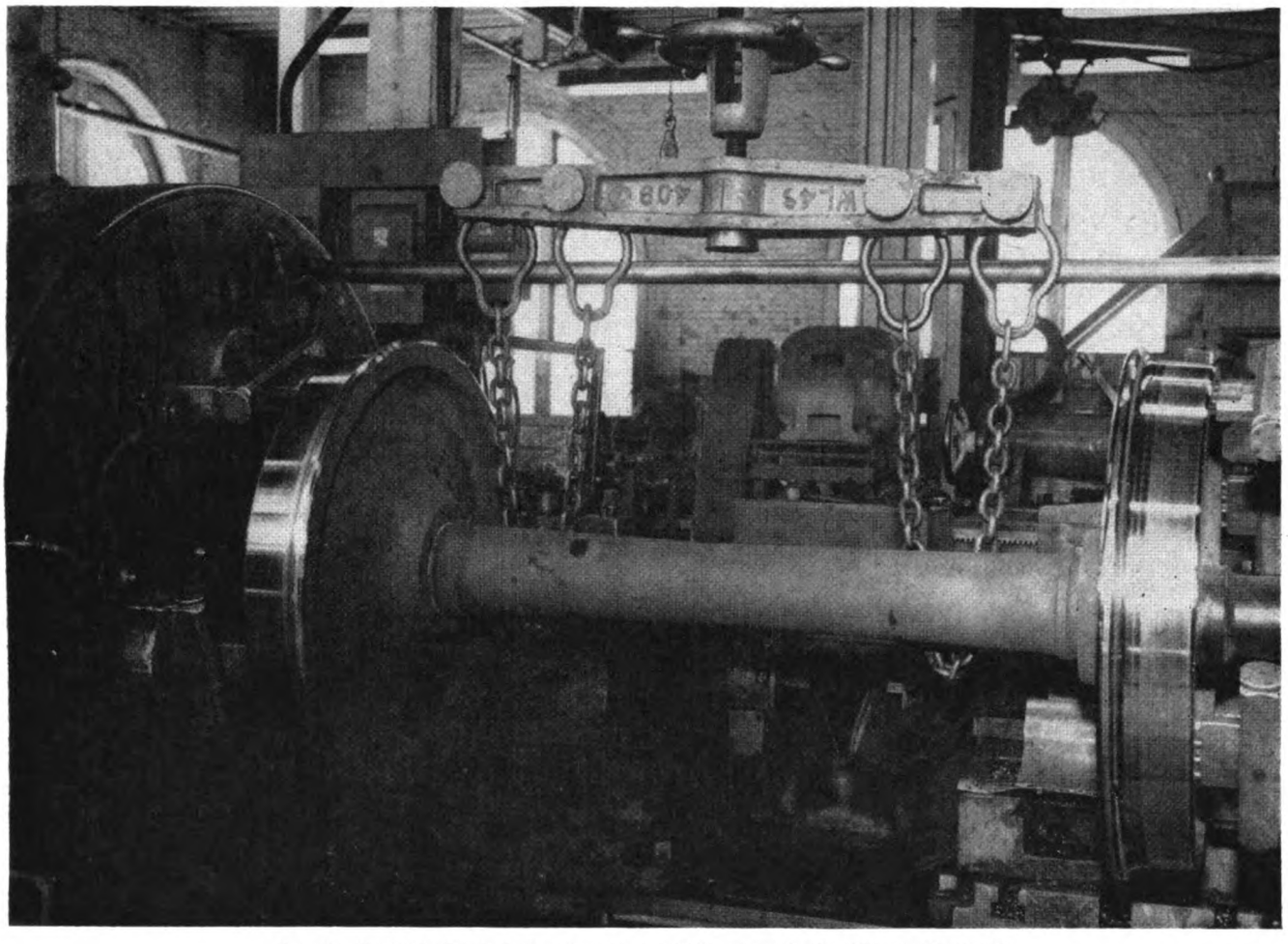
After this drying-out period, armatures and commutators were cleaned by the use of corn meal and sand-blast guns with considerable success at shops not equipped for regular handling of such equipment. In regular traction-motor and armature shops, the above repairs were handled in the usual baking ovens for drying.

Experience showed that, regardless of the drying method used, it was imperative that ventilation be provided to give the air circulation required for removal of the moisture. Armature bearings were renewed because of pitting in practically all of the rollers and races. Frames and armatures were thoroughly washed with a water hose, as silt and mud seemed to respond only to water. Cleaning solvent tended to form a light film or paste that could not be readily removed when dry.

One diesel engine was thoroughly washed and cleaned and an attempt made to load test this unit without removing the engine or generator. This was not successful, because of mud and silt which worked through the engine parts. During the load test, excessive vibration reached a point dangerous for further operation. The engine and main generator were then dismantled and mud was found lodged inside and back of generator blowers and other engine parts, throwing the equipment out of balance. To obtain satisfactory engine performance it was necessary to strip and rebuild all engines.

One fact noted was that crankshafts not Turco-hardened were pitted, but all main and crankpin bearings hardened by this method were found not to be affected.

The 51 flood-damaged diesel units were moved from the ravaged area August 1 and all but two units were in operation by August 17. Approximately 50 truck loads of dirt were removed from these units during the cleaning process. All but one generator and about 10 traction motors passed the required tests after being cleaned and dried and were returned to service.



A pair of steel wheels being turned in 52-in. car-wheel lathe on the S. P.

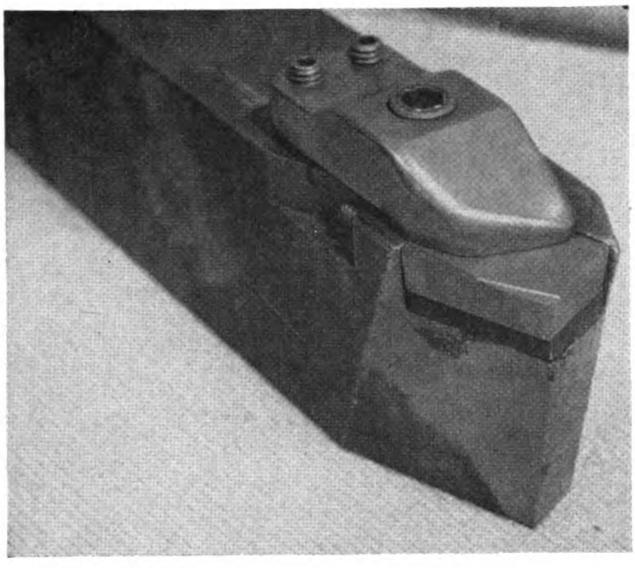
Turning Steel Wheels with Carbide Tools

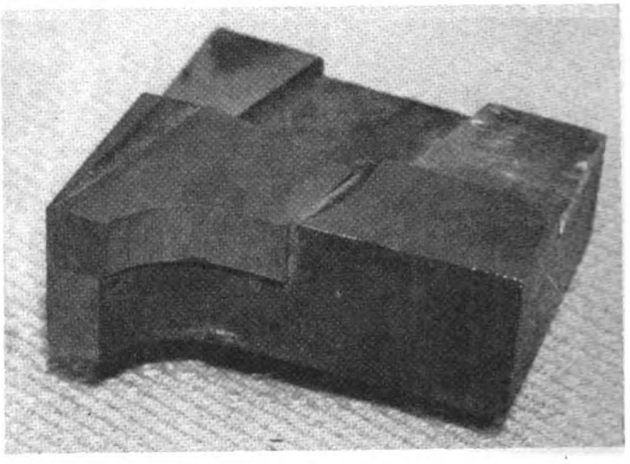
STEEL wheels for steam and diesel locomotives. tenders, passenger and freight cars of the Southern Pacific are turned because of tread or flange wear. on 52-in. car-wheel lathes specially designed for this operation and using carbide-tip cutting tools. One of the machines, installed at the Sacramento, Cal. shop is shown in an accompanying illustration.

The pair of wheels to be machined is placed between the lathe centers and four air-operated clamping dogs are brought into position on the outside rim of each wheel. These clamping dogs equalize themselves during the machining operation so that the pressure of the dogs on the wheels is never more than that required to hold the wheels securely while a cut is being taken. This prevents any warping of the wheels with the result that the finished wheels are concentric within .002 in. The cutting tools are held in a four position revolving turret tool head which is secured to the tool slide.

Until recently, lathes in serice in Southern Pacific wheel shops were capable of a top speed of only 2 r.p.m. which necessitated the use of high speed tools. A solid piece of high speed steel, 1 39/64 in. in diameter by 2 11/16 in. long and tapered to fit into a tool holder, was used for rough turning the tread and flange. The flange was then rough formed using a flange tool and following this, a forming tool shaped to the correct contour was used to finish the wheel to size. The operation was then completed by machining the 5/8 in. radius on the outside edge of the tread with a radius tool.

Wheels which have been in service for a period of time become hard. due to flat spots and pieces of metal





▲ Carbide-tip outside radius tool

◀ Carbide-tip tread-turning tool

being imbedded in the tread, and this caused frequent burning of the speed tools. Also, the amount of stock removal necessary to eliminate the hard spots was sometimes excessive. As a result of these conditions, it required approximately 1 hr. 20 min. to turn a pair of wheels.

During the past few years the Southern Pacific has purchased several new car wheel lathes having sufficient power and speed to operate with carbide tools. Also, the feed mechanism on these new lathes is operated hydraulically and this feature makes possible close control of the required feed.

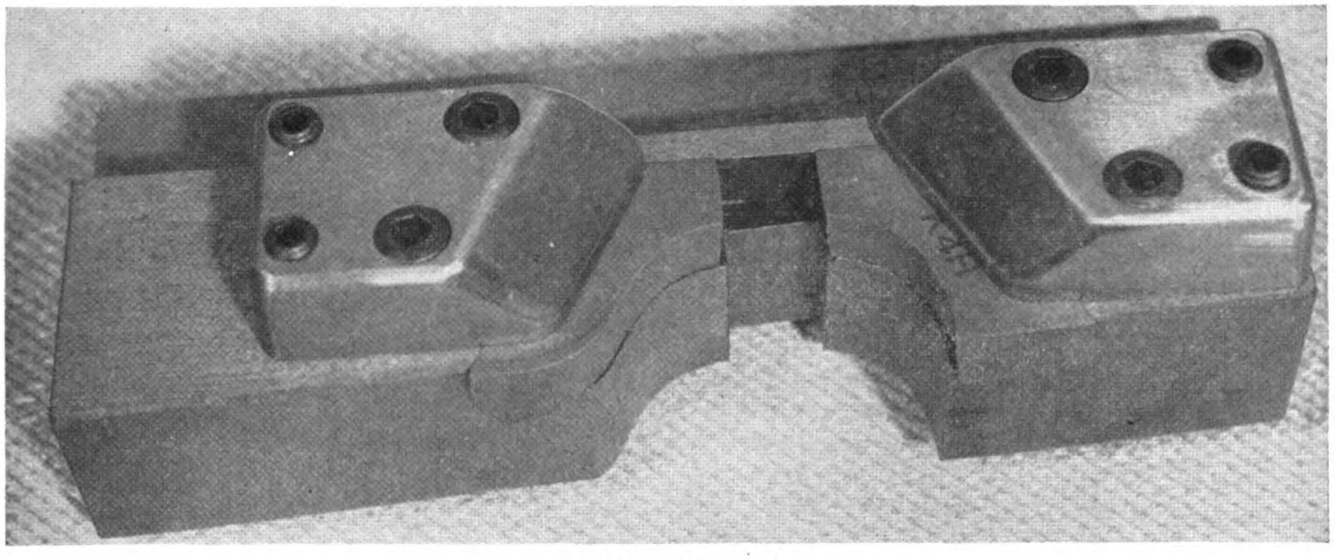
Immediately after installation of the new lathes, experiments with the use of carbide tools were started. The first tool was made using a rectangular carbide tip 1½ in by 1 in. by ⅜ in. brazed onto a 2⅝-in. by 1⅞-in. shank 16 in. long and having a 20-deg. offset. The nose radius of tip was ¼ in. and material was that specified by the manufacturer for normal machining of steel. This tool was used for finish turning the wheel tread and rough turning the flange. The machine was operated at a speed of 20 r.p.m. or 190 surface ft. per min. on a 36-in. diameter wheel, and the feed was approximately .020 in. per rev. of the wheel.

The results obtained were superior to those when using high speed steel, but considerable trouble was experienced with tip breakage and short life. It was felt that some of the tip breakage was due to improper bonding between the tip and tool shank and to the ¼-in. nose radius on the tip being too large which resulted in too much pressure on the tip. In an effort to correct these troubles, a tool holder of the same general design, but on which the carbide tip was clamped, was manufactured. The tip was redesigned so it had cutting edges on all four sides which increased the amount of service obtained, before regrinding was necessary. A grade of carbide having greater hardness was used and the nose radius was decreased to ⅛ in. These changes increased tool life 100 per cent and although tip breakage was reduced considerably, it was felt that further improvements could be made.

It was found that after the tools had been in service for a period of time the surface of the holder upon which the tip was placed had become irregular and the tip was not setting properly. This was overcome by machining the holder ¼ in. deeper and applying a 1 7/16-in. by 3 1/32-in. by ¼-in. hardened tool steel block. The use of this hardened block has practically eliminated tip breakage, because there is now no chance of the seat wearing and allowing the tip to rock and break under pressure. Another improvement was made by polishing the hold down clamp to a high finish. Before this was done the chips would weld themselves to the clamp and eventually destroy it and this difficulty has been overcome by the application of the high polish. The carbide-tip turning tool has proved so successful that it has now been adopted as standard for all car wheel lathes used by the Southern Pacific.

In addition to development work on the tool holders and tips, experiments have been made to determine proper speeds and feeds for the various types of wheels used. Heat treatment applied to steel wheels is determined by the type of service in which they will operated, and the different degrees of hardness obtained affect the speeds and feeds to be used when remachining the wheels. Class AE wheels are relatively soft and can be machined at approximately 20 r.p.m.; Class BR wheels are harder on the rim and the speed is reduced to 17 r.p.m., while the hardest wheels, Class CE, are machined at 15 r.p.m. It should be understood that the speeds given are everage and that changes in metal structure due to temperature, flat spots are imbedded particles of foreign matter may make it necessary to vary the speed during the machining operation. A feed of .020 in. per rev. will normally produce a satisfactory finish on the wheel tread, but as with the speed, this may be varied depending upon the condition of the wheel. Education of operating personnel in the proper use and application of carbide tools is essential in order that best possible results will be obtained.

During the period in which the tool described was being developed, a flange tool made of high speed steel was used for finishing the flange. Since that time a carbide-tip flange-finishing tool has been designed. The cutting portion of the tool is made in two sections to reduce breakage and also to provide easy renewal if one side is damaged. In the original design of this tool, the carbide tips were brazed onto a steel body. However, the great difference in expansion and contraction of the two metals resulted in stresses which caused the tips to fracture after cooling. Another difficulty was experienced due to the fact that the tool



Carbide-tip flange tool

was the exact shape of the finished flange, which made it necessary to feed the tool into the work. With the lathe operating at 20 r.p.m., there was too much contact area for the tool, resulting in considerable tool chatter and a poor finish. It was then decided to separate the two tips and use a side cutting action and this change materially reduced the chatter marking on the wheels. However, frequent regrinding of the tips was necessary and this caused some chipping. The next step was to design a tool having the tips clamped on instead of brazed. This eliminated the tool chattering, but cratering of the tool edge was still prevalent. A small negative rake ground around the cutting edge of the tip was found to be the answer to this problem. Previously the tips had to be reground after turning two pairs of wheels, but since the negative rake has been used, an average of 20 pair of wheels can be machined before appreciable wear takes place. By skillful blending of the flange to the tread, the lathe operator is able to produce a perfect wheel contour.

The final operation in machining a pair of wheel is the forming of the 5/8 in. radius on the outside of the tread. The tool used for this operation is also shown in one of the illustrations. This is the only tool with brazed tips still used in wheel turning and S. P. is at present developing a tool with clamped on tips for this purpose.

The use of carbide tools for turning steel wheels has reduced the time required from 1 1/3 hr. to approximately 27 min. The average time for each of the various operations is as follows: Loading, 4 min.; turn treads and top flanges, 9 min.; form flanges, 10 min. 30 sec.; form outside tread radii, 35 sec.; unloading, 3 min.; total time per pair of wheels, 27 min. 5 sec.

In addition to time saved in the machining operation, another advantage in the use of carbide tools is that the service life of the wheels is lengthened. This is due to the fact that less stock removal is necessary when using carbide tools. The Southern Pacific has found, in many cases, that it is possible to obtain an additional turning on a pair of wheels which would have been scrapped if high speed tools were still in use.

* * *



The Nickel Plate's new Chicago 8-stall combination diesel and steam enginehouse placed in service October 1 will handle an average of 19 diesel switchers, 24 road freight steam locomotives and 4 diesel passenger units. The two stalls nearest the camera make up the diesel section of the house. The steam servicing facilities include the six inside stalls plus a lighted outdoor pit. Complete mechanical turn-around inspection and servicing is given to the road's modern efficient 2-8-4's in an average time of one hour following a 270-mile run from Bellevue, Ohio, but this can be done in as little as 25 min. if the locomotive is needed in a hurry



Why Are Diesels That Way?

Seventeen questions frequently asked about locomotive characteristics, and about features of locomotive management on the road

[This paper was presented before the Railway Fuel and Traveling Engineers' Association at its annual meeting at Chicago, September 17-19, 1951. The author, C. H. Morse, Jr., is manager of the diesel service department. Fairbanks, Morse & Co., Chicago.—Editor.]

IN THE course of your work, you are no doubt asked many questions about diesel locomotives. It may be interesting to take up some of the questions which we are frequently asked and to give you our versions of the answers. In the following, we have tried to keep our answers general in scope rather than applicable to Fairbanks-Morse equipment alone. In some of the items, we have endeavored to provide information either not covered or not fully explained in the instruction books usually available.

What does the horsepower rating of a diesel locomotive unit mean? How does it affect the ability of the locomotive to handle a train?

The horsepower rating of a diesel locomotive unit is the engine horsepower into the main generator for traction purposes. The diesel engine actually develops more brake horsepower which is used to drive auxiliaries such as the air compressors, the radiator fans, blowers, etc.

The rating has no effect on the tonnage which the locomotive can start. This tonnage depends on the weight on drivers and on the factor of adhesion provided by the rail conditions at the time the start is made. At speed, a locomotive of higher horsepower rating will either handle the same train at a higher speed or a heavier train at the same speed. On a hill, however, a locomotive composed of the same number of higher-rated units will handle no greater tonnage without "going into the red" but it will maintain a higher speed with the same tonnage.

This similarity of tonnage ratings assumes that the locomotives have the same gear ratio and wheel size and also have traction motors of the same characteristics. If these items differ, the tonnage ratings will not be the same. At speeds above minimum continuous, these factors will not have any important effect and the comparative performance will be determined by the locomotive unit horsepower ratings.

Why do we have all this electrical equipment such as main generator and traction motors and control system?

The main generator and traction motors are, primarily, a means of transmitting the power of the engine to the

wheels. So far, this equipment represents the only practical method for doing the job.

We have a diesel engine as the source of power, running at a steady speed and producing a practically constant torque when the locomotive is operating at full power. On the other hand, we need high torque at the wheel tread at low speed to start a train or haul it up a grade. Then, on level track, we use all the wheel torque available to maintain speed and make the time. It should be remembered, in this connection, that wheel torque is what produces tractive force and locomotive drawbar pull. Also, tractive force (or wheel torque) times speed (or wheel r.p.m.) is approximately constant while the engine is at full throttle. When speed increases, tractive force falls off and vice versa. The electrical transmission allows us to meet these requirements with an efficiency of approximately 82 per cent and not too much trouble with the equipment itself.

If we could make locomotives that would never run faster than perhaps 20 m.p.h. and always in the same direction, about all the controls we would need would be a throttle to regulate engine speed. But, since locomotives must reverse and make speeds up to 100 m.p.h. or better, the galaxy of reversers, contactors, relays and switches is something we will have to put up with.

Why do the instruction books stress "minimum continuous speed" and "maximum speed"?

A limit is set on the amperage which the motors can stand under continuous operation and a locomotive speed can be determined at which the load meter will indicate this maximum permissible amperage. This speed represents a minimum which must be maintained on the ruling grade. If a greater tonnage is tied on, pulling the speed down below this figure, the loadmeter will go "into the red" and the locomotive will be overloaded with the possibility of damage to the electrical equipment.

The maximum speed limitation is purely for mechanical reasons. If the traction motors turn over too fast, centrifugal force in the armatures can cause damage. The locomotive maximum speed is simply the road miles per hour which will cause the motors to rotate at the specified top r.p.m.

Why do gear ratio specifications differ and how does gear ratio or wheel size affect minimum continuous and maximum speeds and locomotive performance?

In listing gear ratios, some differences exist. One manufacturer will give the pinion tooth number first and follow it by the figure for the axle gear teeth such as "17:62." Another builder will reverse the numbers and give "62:15" as a specification. Note, by the way, that the total of teeth is 79 in the first case, 77 in the second. This variation is simply due to difference in design of the gear train. But either builder will generally stick to the same total-teeth figure through his range of gear ratios. That is, we can expect 19:60, 18:61, etc., in the line of the first manufacturer, 61:16, 60:17, etc., in the second. This rule does not hold on some gear ratios for low speed, heavy pull locomotives where gear manufacturing considerations make a change necessary. A "high" gear ratio is ordinarily considered as being one used on high speed locomotives.

To determine whether one gear ratio is higher than another in any particular range of ratios, compare the pinion teeth figure in any given range—the greater the pinion teeth, the higher the ratio. Between gear ratios of different manufacturers, this comparison may or may not be correct due to differences in the total-teeth figures.

The traction motors will be turning over at the same r.p.m. whenever the loadmeter is at the top of the continuous operation zone, irrespective of gear ratio or wheel size. So, with a higher gear ratio or larger wheels, the locomotive will be running at a higher speed when the traction motors are at this minimum continuous r.p.m. Similarly, the maximum permissible speed will be higher as, with a higher gear ratio or larger wheels, a greater road speed is possible without exceeding the allowable traction motor r.p.m.

So long as a locomotive is not loaded down beyond rated tonnage nor called on to operate above its maximum speed, gear ratio and wheel size make no difference in the way it will handle a train.

Why is field shunting or transition necessary?

As soon as a diesel locomotive begins to move, the traction motors start to generate an internal voltage which opposes the voltage of the main generator. This is known as counter electro motive force—c.e.m.f. for short—and is, in effect, an electrical back pressure. Thus the generator has to put out more voltage to overcome this c.e.m.f. and to force through the motors the amperage which is necessary for motor torque and locomotive pulling power.

As the locomotive speed increases, the c.e.m.f. goes on up. More and more main generator voltage is required. Finally the voltage appoaches the limit for which the main generator and its excitation system was designed. Now something has to be done about it because, if the locomotive speed increases further, the main generator will be unable to produce sufficient voltage for full power output. Each diesel engine will begin to unload and the locomotive will lose power.

To meet this situation, field shunting is introduced or, on some locomotives, the motor connections are changed to place the motors in parallel. In either case, the result is to lower the voltage required from the main generator.

If the speed increases further, after the change, the c.e.m.f. and main generator voltage will go up again and once more reach the desired maximum. A second step of field shunting will be necessary or, on some locomotives, field shunting will drop out and the motors will go into parallel.

Still higher speed will necessitate additional steps of field shunting or the reintroduction of shunting where the motors are in parallel. Finally, a last voltage rise will find the locomotive at maximum speed as the limit is approached.

What happens when field shunting goes in?

A field shunt is nothing but a resistor connected, by closing of "M" contactors, in parallel with the traction-motor field windings. Part of the motor current then flows through the resistor instead of the field winding. This diversion of current weakens the strength of the traction-motor fields and, consequently, the c.e.m.f. is lowered. Then less main generator voltage is required to overcome the c.e.m.f. However, with weaker field magnetic effect, we need more amperes of current flow through the armature to get the same motor torque and locomotive tractive force. This can be seen in the cab by a jump of the loadmeter pointer when field shunting goes in. The resistance of the shunt becomes lower in each step and so diverts a greater proportion of current from the motor fields.

When speed drops due to grade, amperage goes up and voltage down. Now the field shunting steps must be eliminated one by one to keep the amperage from becoming too high. Finally, with all field shunting out, the amperage will rise to red-zone reading on the meter when the speed is down to minimum continuous.

What happens when the diesel locomotive is overloaded

and how can overloading be determined?

When a diesel locomotive is overloaded, it will not maintain the minimum continuous speed on hills. The load meter will go into the red and the electrical equipment will suffer. This fact can often be employed to check the train tonnage on the first grade encountered which is heavy enough to bring the locomotive down to a speed where the motors are in series-parallel (or series) and all field shunting out. On this first rise, the load-meter reading can be taken and compared with the reading observed on previous trips when tonnage was within limits. If the figure is higher than usual, although perhaps nowhere near the red zone, it is a signal that the train is heavy and the meter may go into the red when the ruling grade is reached. With this warning, it may be advisable to notify the dispatcher that the locomotive is overloaded and that it may be necessary to double the hill unless tonnage is reduced.

What inspection should be made before leaving the terminal?

An outside inspection is recommended. If the locomotive units have been separated for servicing, particular examination should be made to see that the cocks are all open in the connections between units. Where a trailing unit is present, the positions of switches and controls in the cab should be checked. In the engine compartments, oil and water levels, positions of isolation switch handles, setting of ground and generator surge relays, battery-charge meter readings, fuel and lubricating-oil pressures and temperatures are points requiring attention. A quick check of electrical cabinets for rags, tools and foreign material is in order. All hand brakes must be released before moving.

In the operating cab, lights and heater operation are tested and, of course, the usual air-brake equipment check is made. Throttle control is tried out by revving up the engines to part speed with generator field off. Then, with generator field on the reverser in forward or reverse and locomotive brakes applied, the throttle is opened to notch 1 or 2 for a few seconds to see that the load meter pointer comes up slightly, indicating that power control is OK.

Ordinarily, the fireman will make the engine compartment checks but it is the responsibility of the engineman to make sure this is properly done. The main thing, on the inspection as a whole, is to establish a routine and follow it faithfully. If such a procedure is set up, it will be found that a quite thorough inspection can be made in very few minutes.

How can I tell if the locomotive is functioning properly on the road?

Here we assume that none of the alarm systems are functioning to show a definite defect. Rather, we will say, there is doubt as to whether the locomotive is handling the train as well as it should.

The first point to check is engine speed—whether all engines are up to the speed called for by throttle control. If one engine is at idle, the fact is quickly apparent. If none are idling, the throttle-position indicator on the Woodward governor or governor operating mechanism should be checked at each engine. Any lack of proper speed control will show up if the indicator does not agree with the throttle position in the cab.

If the engines are all up to speed, the next question is whether they are loading properly. The load indicators on the governors will help to detect subnormal loading. Or, as a check on the indicators, the load regulator positions can be compared in the different units. Some divergence between the load regulators is normal but if one is fully over at maximum field, for instance, while the others are operating in their usual range, under loading is probable in that unit. Failure of transition or field-shunting control is a possible cause and the contactor positions should be checked by visual inspection to see whether they agree with those in the other units. Failure of loading in any unit may also be due to a variety of other causes although the difficulty may be nothing more serious than a blown fuse or a tripped breaker or loss of control air pressure from a shut valve.

Why the load regulator and what does it do?

Inherently, the engine with its governor is a lazy outfit. It will do no more work than it has to in order to keep the engine r.p.m. up to the speed called for by the engineman's throttle. So the load regulator is provided to control the generator output in such a way that the generator will load the engine to the proper horsepower.

Actually, the load regulator is operated by the governor. If the engine demands too much or too little fuel per cycle, oil from the governor under pressure moves a vane-type servo-motor in the regulator one way or the other. An arm operated by the servo-motor carries a brush over contacts and thus cuts in or cuts out resistance in the excitation circuit of either the main generator or the exciter generator.

When locomotive speed is increasing, the load regulators will move toward maximum field, decreasing the resistance in the generator or exciter field circuit. This is necessary because, otherwise, the voltage of the generator would not increase fast enough to maintain full power output and the engine would tend to unload. Similarly, when speed decreases due to grade, the regulator arms move toward minimum field to increase the circuit resistance and cut down the voltage, thus avoiding overloading of the engine.

The oil passages to the servo-motor have needle valves by which the speed of movement of the arm in either direction can be limited. One needle valve is set to limit the rate at which main-generator output can rise after power interruptions such as wheel slip or, when starting a train, if the throttle is opened too suddenly.

Are there any special precautions that can be taken to insure good locomotive performance and long equipment life?

Attempting to haul tonnage which sends the load meter beyond the continuous rating zone is a sure way to shorten the life of the motors and generator. It is true that no failure may occur at the time of overload. But, the heating action of overload operation will cause deterioration of insulation which is cumulative in effect. As a result, the equipment may fail at some future time while operating within loading limits and for no apparent reason.

In this connection, we believe it is not generally appreciated that the heat generated in electrical equipment goes up as the square of the amperage. That is, if we have motors with, say, 1,020 amp. continuous rating and run them at 1,100 amp., the increase is only 80 amp. on the meter, or 7½ per cent. The heating effect, however, is more than 15 per cent greater. Or, if the meter goes up to 1,150 amp., the heat generated will be 27 per cent more than at continuous operation.

How high the motor or generator temperatures will actually go, and how much damage may be caused, depends on the time the equipment is exposed to this heating effect as well as such factors as atmospheric conditions, initial motor or generator temperatures, etc. As equipment temperatures cannot be gauged from the cab, play safe—don't go in the red, except temporarily when

starting a train or for such short-time overload operating periods as may be authorized by special instructions.

A few other precautions may be listed as: throttle fully closed at stops and reduced when passing over grade crossing, care in running through water, coming to full stop before reversing, etc.

In general, what can be done in the way of trouble shooting on the road?

When trouble occurs on the road, the first question is to locate the particular nature of the difficulty. An alarm-system indication may or may not give the answer. A hot-engine alarm is a hot engine but a low-oil alarm is probably caused by anything but low oil. Perhaps low oil pressure, yet, but not low oil level in the engine. So the engineman must have a thorough knowledge of the alarm systems—what common defect will operate each alarm.

If there is no alarm to give a clue to the trouble, the diagnosis can only be made on the basis of a good general familiarity with the locomotive and how it works. Again education is the answer.

Having spotted the trouble, the next question is, "Can or cannot anything be done about it?" Actually, anything that he can do on the road will be minor in nature, such as renewing a fuse, etc., and will take a few minutes at the most.

What should be done if engine operation becomes erratic, makes odd noises, etc.?

Shut it down—but quick! It may, however, be advisable to take a quick look at the fuel gauge or fuel-flow indicator first as an engine may make unusual noises and run irregularly when it is starving for fuel.

After shutting the engine down, leave it alone for a while. Removing an inspection cover would serve no useful purpose and may cause crank-case combustion which can be violent.

If a power plant stops or the engine goes to idle, what can be done?

In either of these cases, an alarm will sound on later type locomotives of some manufacturers. On others, a unit at idle will cause no indicator action. Even when an alarm system does function, the label on the indicator is far from a positive clue to the cause of the trouble in some instances. For example, a "No AC Voltage" or "Alternator Failure" alarm can be and usually is due only to the fact that the engine is stopped, not to any failure in the AC system.

When an engine goes to idle or fails to respond when the throttle is opened, it quite apparently is not getting throttle control. Therefore, the causes for lack of control should be checked, such as tripped ground relay or, on locomotives with ac auxiliary drive, "No AC Voltage" relay out. On some Fairbanks-Morse locomotives, a generator surge relay is used which, when tripped, will bring the engine to idle. Thus, individual makes and models must be studied to determine just what will cause an engine to drop to idle speed. If an engine will not speed up when the throttle is first opened, we can have the additional possibilities of isolation switch in "idle" or a stuck starting contactor on most types.

For a stopped engine, overspeed tripped or lack of fuel are probably the most common causes. In checking a stopped engine, the points for "Engine at Idle" should also be investigated as there is always the chance that the engine went to idle first and then stopped when the throttle was moved to fifth or sixth notch.

What can be checked if the "low oil pressure" alarm sounds and the engine stops or goes to idle?

Except on locomotives using late Woodward governors, with the low-oil-pressure shut-down feature incorporated, look first for all possible causes of stopped engine *but* low oil pressure. In fact, low oil pressure itself is quite an uncommon occurrence and, when encountered, is often not due to any defect in the engine lubricating system proper. Instead, it is caused either by low viscosity of oil when heated by lengthy periods of full power operation or by an "undershoot" action of the governor if the throttle is closed rapidly from the higher notches to idle or by a combination of the two conditions. Also, we can get a low-oil-pressure engine shut down even with normal pressures if the shut-down devices are set too high, particularly if the oil is hot or if the throttle is closed too quickly.

On the road, with governors other than the Woodward type described previously, we check for other causes of stopped engine. Then the engine is started and the oil pressure observed closely while the engine is idling and when it speeds up on the line. An engine with the late Woodward governor stopped with the button out and the "yellow bell" sounding really means low oil pressure, though the lack of pressure may have been due to hot oil or governor "undershoot" or both. The engine is started and allowed to idle. If the low oil pressure condition still exists, the engine will shut down again in about 40 sec.

If it is found that engine shut downs occur after topping a grade, or when starting down hill after a period of full power operation, hot oil or governor action or shut-down device settings can be suspected. On succeeding grades, the throttle can be held open to notch 2 for a short time before going to idle. This will usually allow the governor to stabilize and prevent speed underswing when the final movement is made to idle. If the trouble persists even with this throttle handling, the cause is probably not governor undershoot but one of the other two mentioned. The condition should, of course, be reported.

What is to be done when the ground relay trips?

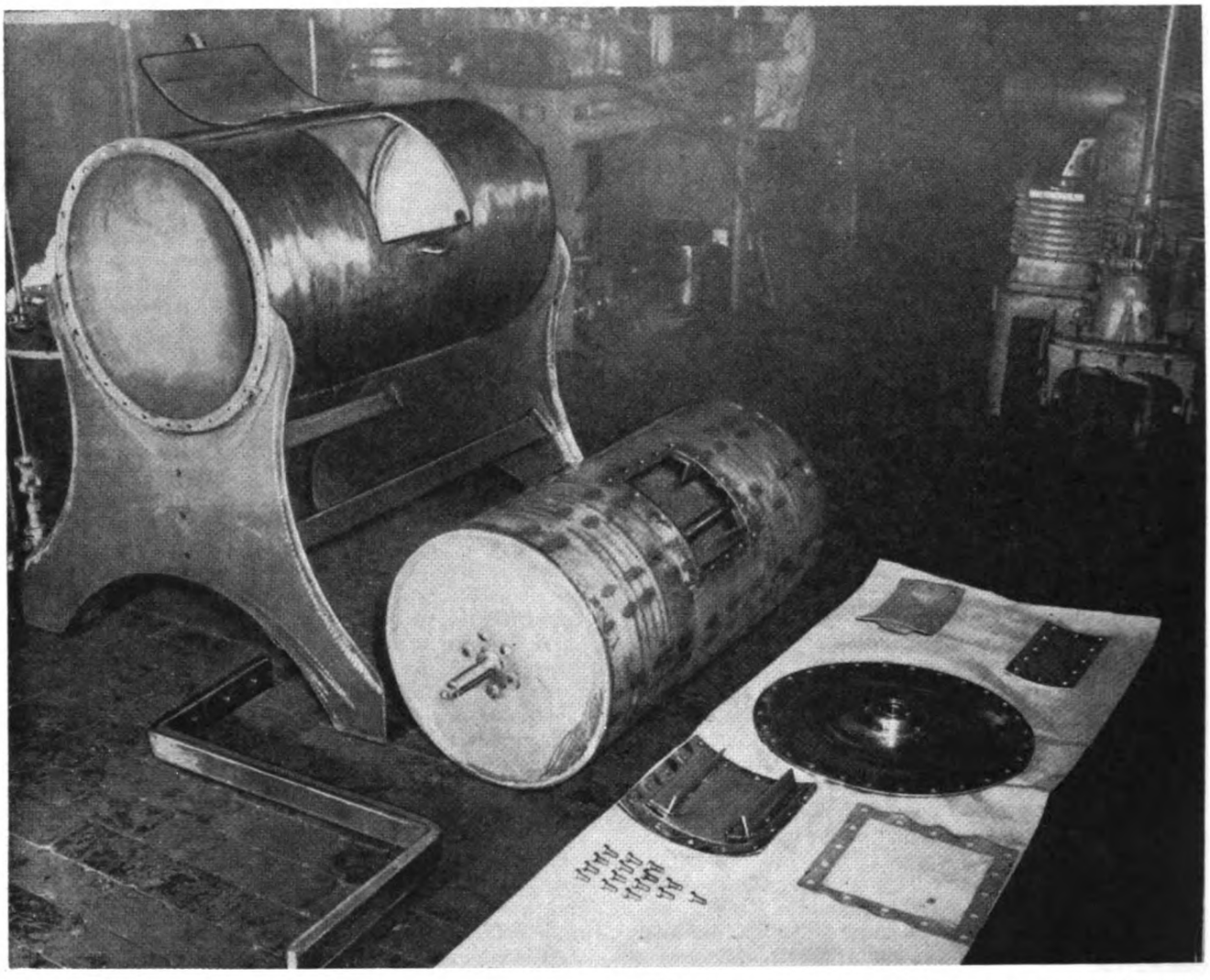
The engine should be isolated, the relay reset and the engine put back on the line. If the relay trips repeatedly, the first step is to cut out the motors, or the trucks, one by one, on locomotives provided with such control arrangements.

When the relay trips in all positions of the cutout switches, if it is possible to get on over the road with the unit out of service, this is definitely the best course. But if the unit must be used, even if only to get into clear, pulling the ground relay switch will allow the unit to be continued in operation. Various railroads have their own rules on the allowable use of this ground relay cutout switch.

On hot engine alarms, what can be done on the road?

Not much. The water level on the cooling system can be checked and the shutters examined to make sure they are opening fully. Many locomotives have levers for manual operation of the shutters if necessary. The fans can be checked for proper operation but, if they are not running, there is probably no action which can be taken on the road outside of testing the fuses used in some radiator-fan motor circuits.

Cooling system temperatures may go well above normal in hot weather although no defect exists. The systems are designed to hold the cooling water temperature down to normal so long as the atmospheric temperatures do not exceed some particular figure—usually 75 to 80 deg. If the weather goes above this temperature, the cooling water may go up as well. This action represents no defect and no action need be taken.



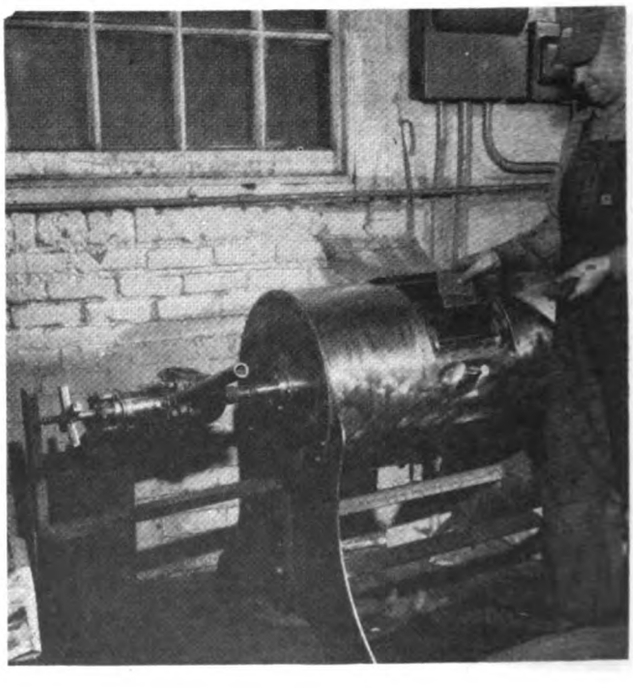
▲ Construction parts of the harmonic-balancer spring pack cleaning machine

Spring Pack Cleaning Machine

Harmonic balancer spring packs can be cleaned in about one hour by one man using the machine shown in the illustration. One set fits in a drum 34 in. long and 17 in. in diameter and is revolved in a mixture of soluble oil and sand, using a 5-gal. bucket full of sand with 3 gal. of oil.

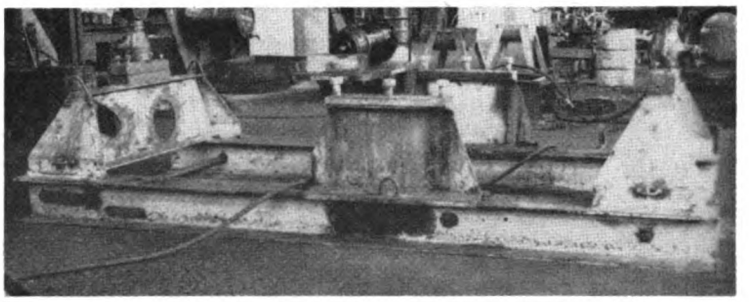
The drum is made of stainless steel, $\frac{3}{16}$ in. thick. Inside are 7 strips of $1\frac{1}{2}$-in. angle iron welded lengthwise to agitate the contents. The drum is driven at 25 r.p.m. by a 1-hp. electric motor and it turns on two ball bearings. To protect workmen from all moving parts the revolving drum is encased within a stationary drum, also made of $\frac{3}{16}$-in. stainless steel.

The revolving drum is constructed by flanging over the edges of the cylindrical portion and bolting the end pieces to the edges through a rubber gasket. The drum is loaded through a door 8 in. square which is closed off during the cleaning operation by a plate. The stand on which the drum is mounted and revolved is made of $\frac{1}{4}$-in. plate and $1\frac{1}{2}$-in. angle.

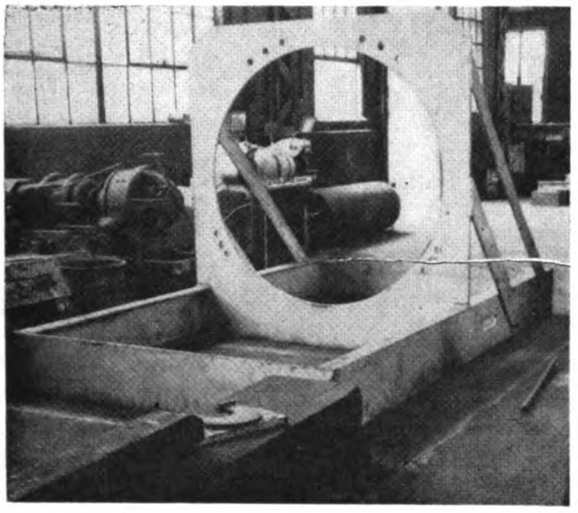


➤ Spring pack harmonic balancer sets are cleaned in one hour on this cleaning machine. The air motor shown above has been replaced by a 1-hp. electric motor

Shop Ideas from the Katy

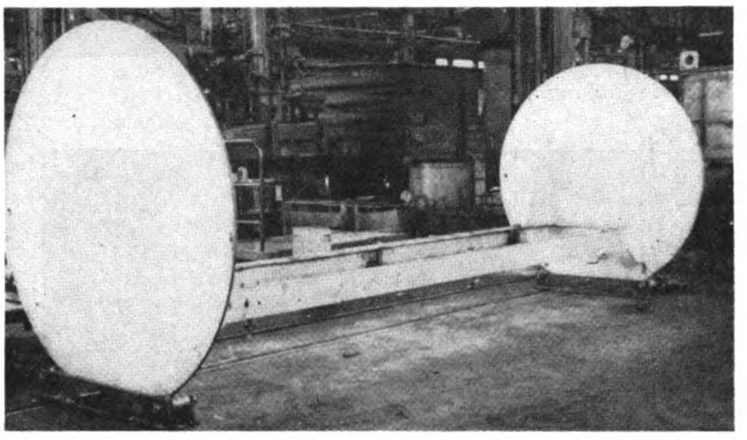


▲ Layout for removing armatures from E.M.D. generators. The housing is supported on the center section, which slides back and forth, while the bearing end of the generator is supported on the cradle of one of the jacks. A shaft rests on the remaining jack and extends into the opening in the end of the generator armature. Raising both jacks suspends the armature, permitting the center section of the stand with the housing to be moved with ratchet hoists until the housing clears the armature. Putting a sling around the armature holds it for removing and carrying the stub shaft

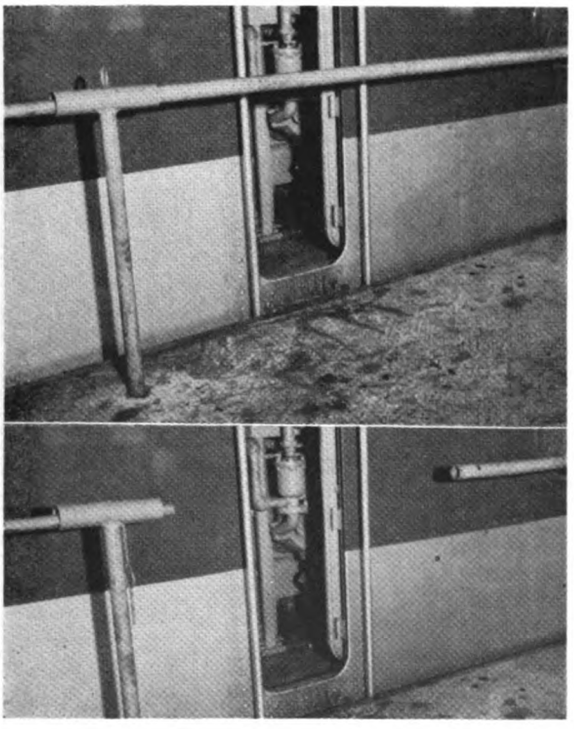


▲ Generators from Baldwin and Alco locomotives while held in the above stand, are cleaned by blasting with ground corn cobs at the Parsons, Kan., shops of the Missouri-Kansas-Texas

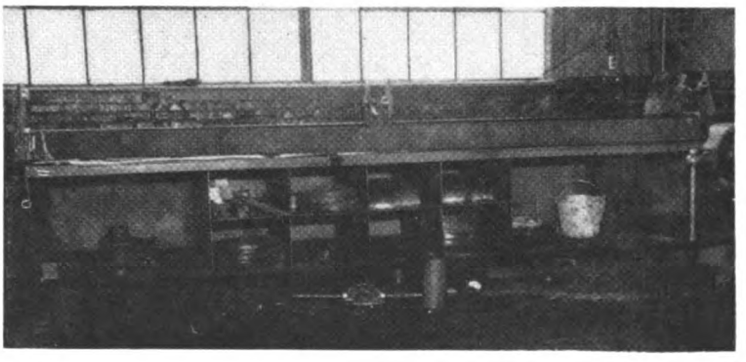
▼ Crankshaft removal and application stand used at Parsons, has two circular sections of 1-in. plate mounted on rollers and can be turned by hand. The crankcase is located and secured by six bolts. The stand is revolved and positioned by use of four dowels

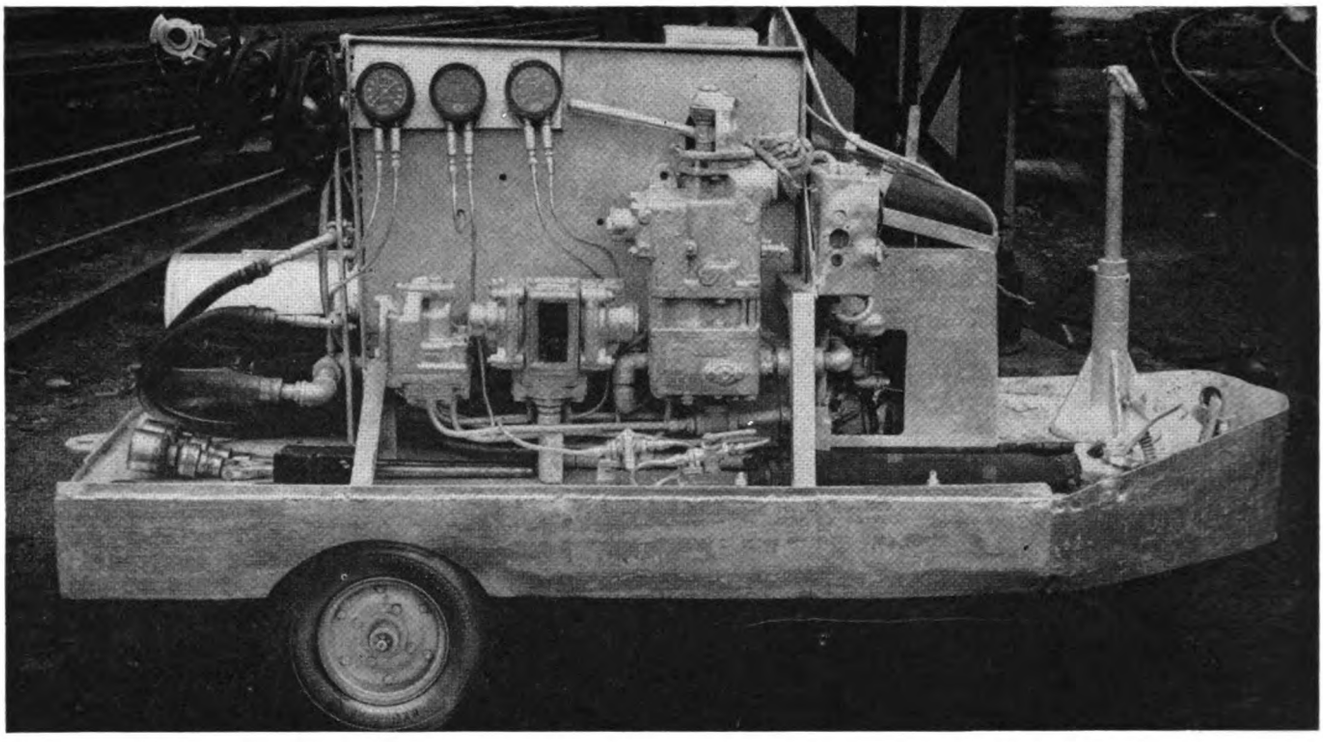


◀ Where diesels with different distances between door openings are handled, telescoping guard rails can be opened at any point or points for access to the inside of the locomotive. This installation is made of three different sizes of old flues, secured in place by the pin in the post as shown in the upper section. The pipe slides out for entering the doorway as shown in lower section

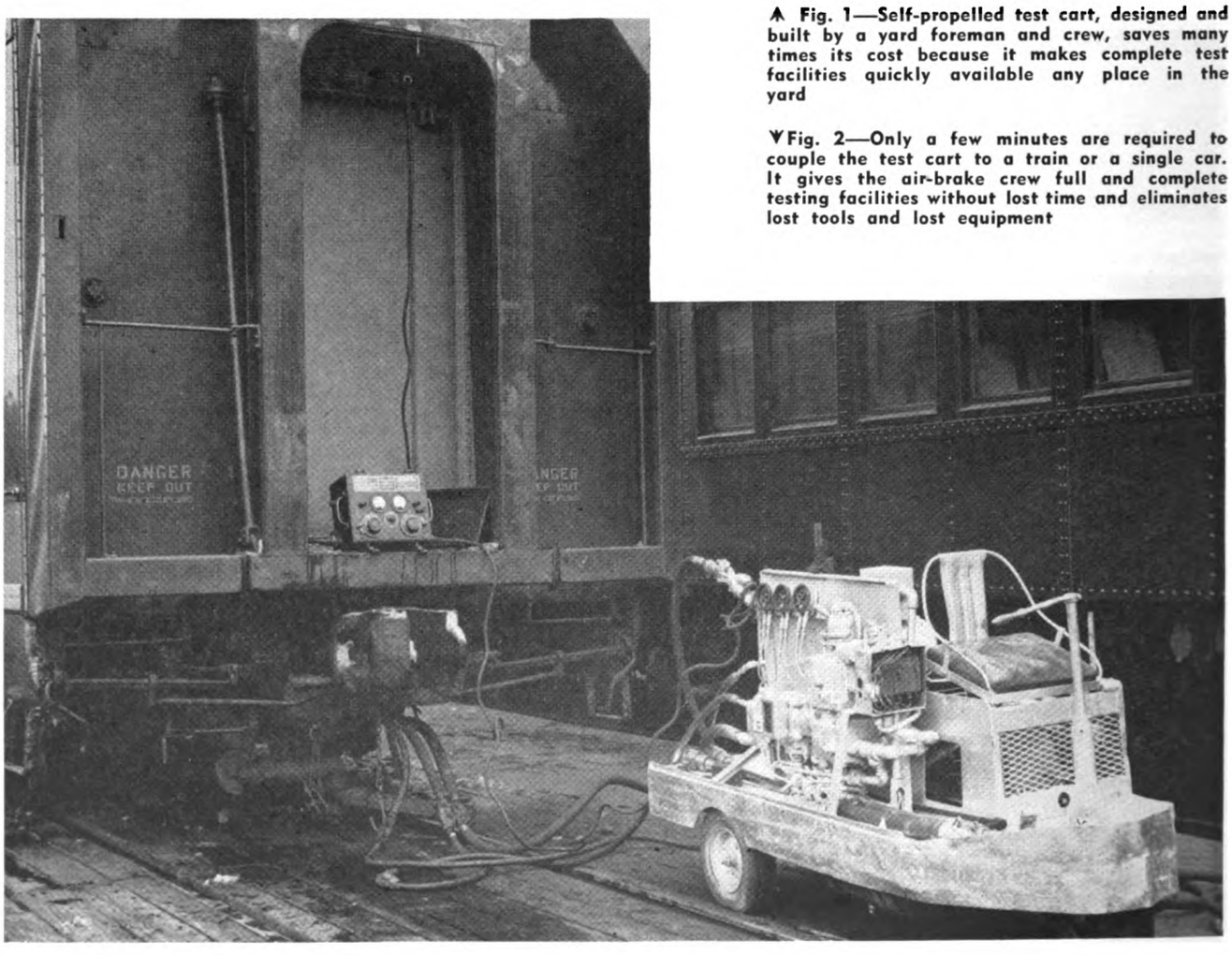


▼ Stand for polishing crankshaft throws. The crankshaft revolves on three pairs of ball bearings while driven by an air motor through a plate bolted on the end with a boss that fits in a drill chuck on the motor. Polishing is done with crocus cloth, either by hand or by inserting it in split hinged members with holes the size of the connecting-rod bearings





▲ Fig. 1—Self-propelled test cart, designed and built by a yard foreman and crew, saves many times its cost because it makes complete test facilities quickly available any place in the yard



▼ Fig. 2—Only a few minutes are required to couple the test cart to a train or a single car. It gives the air-brake crew full and complete testing facilities without lost time and eliminates lost tools and lost equipment

Maintenance of Car and Diesel Clasp Brakes*

THE fundamental reason for practically all brake maintenance is safety. Safety is the primary and dominant factor in anything having to do with brakes for the reason that brakes are the basic safety system of a moving train. Brakes, brake parts, and brake mechanism must not fail; the brake must be built and must be maintained so that normal wear or malfunction of some part will not prevent the brake from stopping the train. The entire philosophy of brake design and maintenance is based on this formula: Reliability must take precedence over all other considerations.

When reviewing the work necessary to keep a braking system safe, it is apparent at once that there are two general kinds of brake maintenance. The first is repair maintenance, that is the repair or replacement of some part or mechanism which has failed or is worn to the condemning limit. Such work is done following daily inspection or at the time of general truck overhaul. The other kind of maintenance is preventive maintenance. This is the kind of work which does not wait for a failure, but attempts by inspection and adjustment to anticipate the trouble and to do something about it before it occurs.

In the railroad field, because of our being "safety-conscious," we have devoted the greatest amount of our attention to making brakes absolutely reliable and dependable; the brake designer has been asked to design and build a brake which will be so reliable that it will safely run for about half a million miles without heavy repairs.

Operating conditions of the modern passenger train have undergone considerable change in recent years and these changes have raised serious maintenance problems. First, there has been a substantial increase in speed: 50 and 60 m.p.h. schedules have been increased to 80 and 90 and even higher. This has brought an increasing importance to safety and has greatly multiplied the problems of keeping the mechanism in proper working order when it is subjected to the intense vibration accompanying high speeds.

Second, the idle hours per day available for maintenance work have been drastically reduced. Years ago passenger equipment was called upon to make the Chicago-Denver run two or three times a week. Today the equipment must make the run every day, seven days a week. There is no question of having the train ready to run tomorrow; it must be ready to run today. Much modern passenger train equipment is actually only available for maintenance work for a few hours once a day, and in some cases once every three days, so that work must be done quickly and on a carefully planned schedule. Third, because of the demands for improved performance, brake equipment on the passenger train is no longer the simple mechanism which adequately served on earlier equipment. Electric and pneumatic control apparatus has become more vital and complicated. Operation and adjustment of the brake mechanism has become increasingly complex.

This has brought large increases in the amount of skilled labor required and need for expensive maintenance equipment and facilities. Meanwhile the cost of all labor, skilled and unskilled, has steadily increased.

It appears therefore that operation of high speed passenger trains demands increased maintenance work done in less time and with more expensive labor and materials. All of which means that the air brake man must give it much more careful thought than he has in the past.

Preventive maintenance breaks down into two separate factors. First, inspection, that is, the discovery of danger signals, the constant search for trouble before it happens. How often and thorough and detailed should this inspection be? What are the danger signals to look for and what is the surest and most economical method of finding them? Second, once the danger signals are discovered, what should then be done about it?

When safety is involved, there is no question—correction must be complete and immediate. Assuming that no parts are broken, worn out or in an inoperative condition, there may be a difference of opinion as to what constitutes safe and suitable condition for service. We shall outline what we believe to be minimum requirements.

Before attempting to examine the details of how this problem should be approached, it may be well to run through a typical operation involving a modern high speed train and sketch out the nature of the maintenance work which must be done to keep its brakes in order.

Maintaining the Empire Builder

We have chosen for this purpose the "Empire Builder," operating daily Chicago to Seattle over the combined facilities of the Great Northern and the Burlington. It is similar to the Denver and Nebraska Zephyrs, North Coast Limited and the Western Star. All of these trains are equipped with clasp brakes and approximately 250 per cent braking ratio.

The Empire Builder is a typical high-speed, modern streamliner train of 15 cars, operating daily between Chicago and Seattle, 2,211 miles, with diesel locomotives most of the way, and electric locomotives over the Cascade Mountains. The train operates across all types of terrain with long stretches of water level track at both high and low altitudes, with normal cruising speeds of 80 to 90 m.p.h., and over severe mountain grades which involve long continued heavy braking. Great extremes of temperature are experienced during a run, including some of the worst cold and icing conditions to be found anywhere.

The train is equipped with automatic sanders on all cars, electric-pneumatic brake control standard clasp brakes, 18½-in. shoes and with three different types of anti-wheel slide devices.

To test such trains in the yard, we use the test device mounted on a chore boy shown in Fig. 1. It is equipped with a complete set of HSC locomotive brake schedule, with proper air and electric connectors to the yard and train. A motor generator is used to supply current for the electro-pneumatic brake.

After the test device is coupled to the train, two me-

* Abstract of a paper presented before the Air Brake Association by a committee on clasp brake maintenance of which H. I. Tramblie, air brake engineer, C.B.&Q., is chairman.



Fig. 3—A set-up which provides complete facilities for handling air-brake cylinder conditioning and assures that the job is done completely, accurately and quickly at low cost by eliminating waste labor

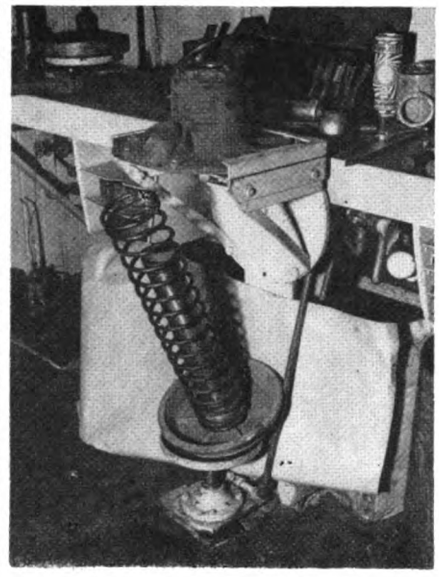


Fig. 4—Power operated fixtures not only save labor and time but assure uniform quality work. Here the piston and spring are ready for assembly with the head



Fig. 5—An air motor driven spinner for polishing brake cylinder sleeves not only saves time but does a better job than makeshift methods, and makes a workman proud of his job

chanics start along the train, one on each side, to check for leaks, position of cut out and angle cocks at the control valves, brake cylinders and between cars. They also run automatic slack adjusters back if necessary, note position of hand adjusters and take up holes in pull rods.

When reaching the rear of the train they open the brake pipe and signal cut out on the rear to insure a full flow of air and to blow out any dirt or moisture which may be in the pipes.

They then return to the head end; one man inside tests the signal valve and hand brake on each car. The other man outside checks the hand brake chains and couplings. When reaching the head end, they make a full automatic service brake application, then one on each side checks the piston travel, marking any necessary correction on the brake cylinders with chalk, they also check the anti-wheel slide devices and car sanders. Electricians at the same time check the electric brake circuits with a circuit checking device and go through the train looking for loose or broken wires in the connectors or plugs. One man returns to the head end, closing the straight air cut out cock on the head end of each car. When reaching the head end he releases the brake, then both men walk the train checking the release and correcting piston travel.

Next, the man at the rear operates the back up brake valve, in straight air, automatic service and emergency. The head man observes that brakes apply and release on the head car during each test. The rear man then signals for an electro-pneumatic application from the head end. After making a full brake application from the test device, the head man opens a switch in the application circuit.

After waiting two minutes, both men walk the train to see that each brake is applied and that there is no noticeable leakage at the magnet valve exhaust or in the hose coupling or cut out cocks and that the relay valves are not pumping.

The brake is then released, and one man walks the train to check release and to open straight air cut out cocks. Any defects found are corrected: about two hours and forty-five minutes are usually required for this work on a 15 car train. This time does not include that required for brake shoe change, daily filling of sand boxes or repair and replacement of parts found defective.

TABLE 1—CLASP BRAKE RIGGING ADJUSTMENT AND CHECK CHART

CONDITION	CAUSE	CURE
Piston Travel Too Long	1. Automatic slack adjuster not operating	Remove or repair adjuster.
	2. Automatic slack adjuster run out	Adjust manual slack adjuster or take up hole in top rod.
	3. Worn pins and bushings — slack rigging	Renew worn parts.
Piston Travel Too Short	1. Not adjusted after installing new wheels or shoes	Adjust automatic, manual or pin holes as needed.
	2. Frozen pins or levers in rigging or elongated holes in bushings	Free moving parts and renew badly worn parts.
Brake Shoe Tapered Top or Bottom	1. One-way travel	Reverse shoes.
Brake Shoe Off Wheel Tread or Rubbing Flange	1. Sloppy or worn rigging	Renew worn parts.
	2. Loose or worn brake head	Apply new head.
	3. Balancing device not effective	Repair or replace defective parts.
	4. Bent beam or rigging	Renew damaged parts.
Brake Shoe Burned	1. Stuck brake	Make single car test
	2. Hand brake set	Release or adjust hand brake.
Brake Shoe Loose in Brake Head	1. Worn head	Apply new head
	2. Bad brake shoe key	New key.
	3. Bad slot in shoe	New shoe.

After the engine is coupled to the train, the regular AAR-ICC prescribed tests are made, with the automatic, electro-pneumatic, straight air and also an emergency application.

In addition to the daily routine we have just outlined, there are monthly tests of speed governor control and a monthly check of hand brake operation which must be made on each individual car.

It is important that inspection and maintenance routines such as these be carefully planned by foremen and supervisors so that men will understand fully what they are expected to do and will follow identical routines day after day. This will save time and make certain that the job is done thoroughly.

Table 1 is an example of how brake rigging inspection

and adjustment procedure can be organized. It shows the conditions a mechanic is expected to look for, the causes of these conditions and the proper repairs to be made.

We believe this intensive maintenance is justified. By doing more than the required minimum maintenance, we get three very valuable benefits which are well worth the costs.

The first benefit is a decided improvement in the operation of the brake. Holding piston travel to between two and three inches gives a very sensitive brake with a highly uniform response. It enables the engineer to handle his braking smoothly and with a degree of precision not otherwise possible. Overbraking and overuse of the brake is reduced and there is a very considerable saving of air and fuel.

The second benefit is a marked reduction in brake shoe wear. The Empire Builder and similar trains are consistently showing 25,000 to 30,000 miles on brake shoes. Shoes can quite safely be worn down to the last half inch and still be safe for the 2,200-mile run from Chicago to Seattle, or like mileage on other runs. Brake shoes are *not* changed en route.

The third benefit is a substantial reduction in wear on the brake rigging, with a longer time between shopping periods and a marked reduction of worn parts. High speed operation and destructive vibration go hand in hand. At speeds above 60 m.p.h., a loose or sloppily adjusted brake rigging may be shaken to pieces. It is well known that brake rigging parts wear out due to vibration. not by use.

As an example of how well this extra maintenance pays off, the Empire Builder equipment went into operation at the beginning of 1947, and all six trains operated continuously, without a spare car, for over two years. Not a single car had to be withdrawn from service during this period because of brake trouble. When a spare car became available in the spring of 1949, one car was withdrawn from service for inspection and shopping. Measurements of actual wear on all working parts of the rigging disclosed that, on the basis of some 650,000 miles of service, no serious wear was indicated, and that in all probability the best part of a million miles of wear could be anticipated before it reached the point of requiring renewal of parts.

It appears to us, therefore, there can be no doubt that it is far less expensive in the long run to do a complete, careful and thorough job of preventive maintenance and have the benefit of improved service, long life and reduced repair costs, than it is to do a minimum job and have the disadvantages of poorer service, shorter life and higher repair costs.

Limits of Wear

In setting up the program of maintenance to be followed, it is necessary to fix standards: standards of procedure and standards of wear. These must, of course, be made to fit the individual requirements of each railroad.

It is essential that all parts of the brake rigging shall be maintained in accordance with standard drawings as to levers, pins, hangers, brake beams, etc., to avoid change in braking ratio. Brake rigging parts should be renewed or reconditioned when worn to the following limits:

Auxiliary levers, truck levers, cylinder levers and equalizers: A total surface wear of 1/8 in. maximum permissible on thickness at all pin connections.

Balance hanger brackets: (Generally 1/2-in. spring steel) Maximum wear of 1/8 in. thickness in eye portion is permissible.

Brake beams and brake hanger connectors: Wear on trunnion bushings beyond the hardness penetration, generally 1/32 in. deep for bushings of this type, will be rapid; therefore, any bushings with over 1/16 in. wall wear from original outside diameter should be replaced.

Brake hangers and hanger levers: Surface wear of 3/16 in. total on faces at top and bottom of brake hanger is permissible.

Brake heads: Wear on face of brake heads should not be to the extent that a brake shoe cannot be held tightly by means of a key to the head. A total surface wear of 3/32 in. on each jaw at the pin hole is permissible.

Brake head balancing devices: With one way travel, tapered wear of brake shoe may be expected. On long shoes this may average about 1/4 in. per shoe. Occasional shoes may show more than average tapered wear and should be reversed to save waste metal. (The purpose of brake head balancing devices is to permit the head to adjust so that the shoe holds concentric with the wheel in the released position under various conditions of wheel diameter and shoe thickness. Practically all these devices function by providing friction from spring pressure; consequently, maintenance will consist in making sure that adequate spring pressure is obtained. Worn parts should be replaced or built back to new dimensions so that adequate spring pressure is present. There should be sufficient friction so that the head cannot be moved by hand.

Clevises: Surface wear of 1/16 in. on each jaw at pin hole is permissible. A diametric reduction of 1/8 in. maximum is permissible in rod portions originally over 1 in. in diameter.

Connection straps: Surface wear of 1/16 in. pin holes is permissible.

Pull rods: (Generally also applies to brake beam fulcrum, fulcrum brackets and bars, and hanger lever brackets) Surface wear of 1/16 in. on each jaw is permissible.

Guides and supports: Wear of 75 per cent of the general original thickness of 1/4-in. wear plates is permissible.

Bushings and pins: Combined wear in assembly of associated brake pin and bushings of 1/8 in. should be considered maximum on conventional passenger cars, locomotive tenders and diesel switchers; however, a combined wear of 3/32 in. in a similar assembly should be considered maximum on high-speed passenger cars, tenders and diesel power units.

Any appreciable wear of pins or bushings in a brake system reduces the brake shoe clearance provided in the brake system. A clasp brake is designed to operate at a prescribed piston travel, thus providing a reasonable amount of clearance at each brake shoe, and any appreciable wear of the pins or bushings increases this piston travel; the piston travel is distributed at the various worn pin connections and the remainder becomes brake shoe clearance, which is subtracted from that originally provided.

Worn pin and bushing assemblies and worn brake parts also contribute to noises and other disturbances to passengers. Piston travel of truck-mounted brake cylinders depend on the type of control valve; with UC schedules the rigging is usually designed for 5-in. travel to conform with reservoir sizes.

With D-22 or D-24 schedule, the piston travel should be adjusted for 2-3-in. slack adjuster set at 3 in., particularly in solid trains of this equipment; it has been found desirable to keep the piston travel as short as possible to facilitate the application and release of brakes. When anti-wheel slide devices are used, the efficiency of

Fig. 6—This automatic slack adjuster engine has been throughly cleaned for inspection, lubrication and reassembly



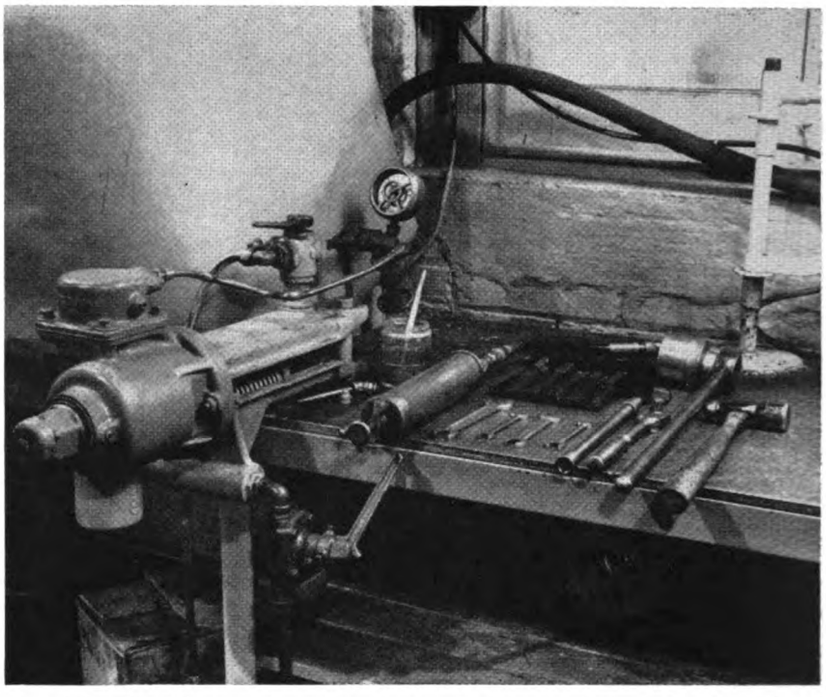


Fig. 7—After reassembly, an automatic slack adjuster is connected and completely tested at this station to make sure that operation and adjustment are correct

these devices depends to a considerable extent on the volume of air to be handled and the time required to release the shoes from the wheel. It is also desirable to keep the piston travel short and uniform throughout the train to insure uniform wear of brake shoes. This will materially increase the mileage life of shoes as compared with longer and uneven travel. Burlington practice is to adjust all piston travel to 2 in. on cars or diesel units with D-22 or D-24 schedule.

At the time of periodical air brake cleaning on passenger cars with truck mounted brake cylinders and on diesel units, the brake cylinder pistons with non-pressure heads and the automatic slack adjuster engines are removed and taken to the shop for cleaning, repairs and lubrication. Fig. 3 shows the bench, with tools and jig used in dismantling, repairing and assembling the piston and non-pressure head. With a tool for each operation, time consumed is held to a minimum—about 15 min.

Fig. 4 shows the assembly after the piston and spring have been backed out of the head. Fig. 5 shows the piston and sleeve mounted in a rotating jig, where the mechanic polishes the sleeve with emery cloth when necessary. Fig. 6 shows the automatic slack adjuster engine dismantled; all parts have been cleaned, inspected, repaired or renewed, ready for greasing and assembly.

Fig. 7 shows a repaired engine mounted on the test rack where its operation is carefully checked before being returned to service.

The trucks under all high speed cars and diesel units are removed and sent to the shop for general overhaul about each 24 months, or after about 650,000 miles of service. When trucks are in the shop for overhaul, all parts are restored to new dimensions.

To insure proper piston travel and brake lever adjustment, the mechanic must understand the function of each device used in adjusting the brake. On a typical high-speed four-wheel truck, the top pull rod is just beyond the brake cylinder. This rod has a three-hole jaw at one end and a hand operated screw adjuster at the other end. The three holes are provided to adjust the rod for the correct length when wheels are changed.

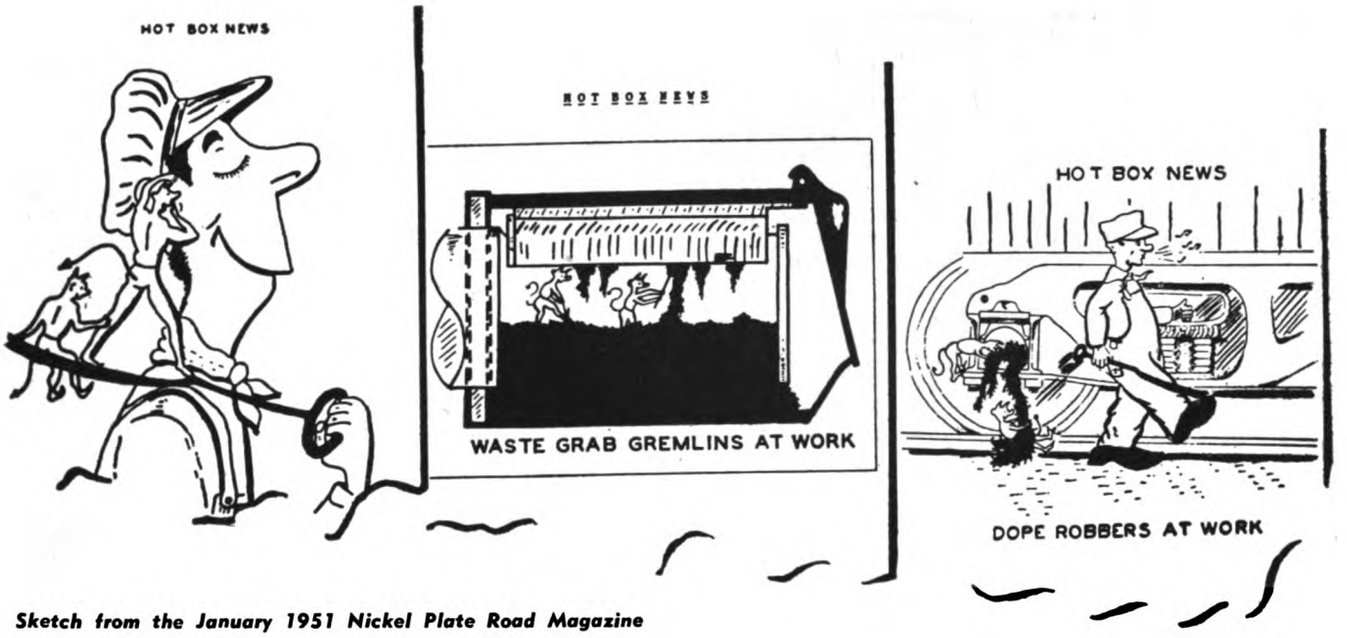
The hand adjuster is used to adjust for the desired piston travel when shoes are changed. The automatic slack adjuster shown near the brake cylinder is for the purpose of making adjustments to keep the piston travel at the desired value as shoe wear takes place while the train is in operation. It should be run back as near as possible to the starting position in order to obtain the greatest possible reserve travel, to compensate for wear.

When this re-setting of the automatic slack adjuster has been made, the manual slack adjuster should then be run in or out to produce the desired piston travel. If the travel of the manual screw adjuster is insufficient to compensate for wear or to bring the piston travel to the desired value, the additional range of compensation necessary is available by changing the pin adjuster at the other end of the rod.

On a typical six-wheel diesel truck similar adjustments are made to get correct piston travel. The details of the rigging are different but the principles are the same. There are two cylinders and two manual slack adjusters located below the axles instead of at the top of the rigging as in the four-wheel truck.

We have found beyond question that high quality brake maintenance is the most economical in the long run. It is possible to cut maintenance to the bone and do only the minimum required to keep the brake operative, but such practice will not promote economy or safety.

The elimination of loose and floppy rigging which rapidly wears out at high speed, will more than pay for itself in longer life and reduced repair bills. Accurate adjustment pays rich dividends in increased brake shoe life and in giving the engineer a precision brake which improves handling and makes overbraking unnecessary. Poor workmanship is always most expensive in the long run. The most economical way to do a job is to do it right.



Sketch from the January 1951 Nickel Plate Road Magazine

Ways to Prevent Hot Boxes

THE statistics on hot boxes on freight cars issued by the Association of American Railroads, Mechanical Division, monthly led to a discussion, at a recent meeting of the Anthracite Valley Car Foreman's Association, Scranton, Pa., of letters outlining practices instituted by four railroads having the best hot box performance. Some of these practices are:

- Increased yard and maintenance forces
- Arouse interest to prevent lack of attention
- Renew all dust guards when wheels are changed
- Incoming inspection of all journal boxes
- Adequate amount of packing in journal boxes
- Better truck maintenance
- Special attention at points where the business volume justifies
- Policing of operations
- Special assignment of lubrication engineers to supervise, educate and inspect lubrication activities.

It was brought out that different maintenance and operating practices no doubt influence the hot box mileage performance. For example, on some roads journals are rebrassed en route by train crews and since such cars are not set out they are not counted, whereas on most railroads, the cars developing hot boxes are set out.

Attention was called to axle journal damage caused by retainers in boxes on Andrews type trucks. The recommendation was made (by a committee) that retainers be removed from such boxes and further that railroads be restricted from applying retainers to any journal box where journal box bolts are used.

It was reported that considerable trouble has been experienced with end worn bearings due to the poor finish on inside of collars on new and reconditioned axles, which condition also has a tendency to disturb the journal box packing.

In the interest of education and promotion of efficiency, one member reported that on his railroad a system has been introduced whereby any employe engaged in box packing must first be qualified before undertaking such work. To that end he is properly instructed in the packing of boxes by a qualified supervisor and required to answer orally questions pertinent to the work. When qualified, a certificate to that effect is kept on file.

The following outline of procedure followed, which consists of oral and field examinations may be of interest:

Q.—What kind of packing is to be used when packing a journal box or when adding packing to a box when there is an insufficient amount in the box?

A.—New or reclaimed packing. Sec. 7, Para. A.

Q.—What condition should the journal box be in before starting to pack it?

A.—Thoroughly cleaned.

Q.—What is the first operation to be performed when packing a journal box?

A.—Hand made back roll properly applied. Sec. VII, Para. B.

Q.—How should the body of the packing be applied?

A.—One piece method. Sec. VII, Para. D.

Q.—How high should packing be on the sides of the journal?

A.—One inch below the center line of the journal along the sides. Sec. VII, Para. D.

Q.—Should the packing be firmly placed in box?

A.—Yes, firm enough to fill the space under the journal and bear evenly along the sides but not too tight to retard capillarity; i.e., the oil flow through the waste. Sec. VII, Para. C.

Q.—How much free oil should be in the journal box after packing?

A.—Approximately one inch. Sec. VII, Para. F.

Q.—When adding additional packing to a journal box when same is being treated, what procedure should be followed?

A.—Pull sufficient packing across the full width of the mouth of the box and allow strands to hang down outside. Add packing so it will have the effect of binding all of the body of the packing in one piece. Sec. VII, Para. D.

Q.—When packing boxes with and without retainers, what methods are to be used?

A.—(a) With retainers—Packing should be placed vertically down on the inside of collar. Fig. I-C.

(b) Without retainers—Packing should extend on a 45 deg. angle from underneath the inside of the collar. Fig. I-CI.

Form of Certificate

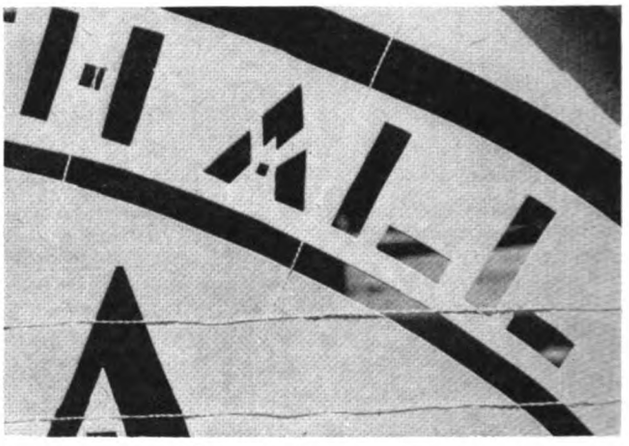
John Doe, box packer, has been duly examined and has qualified that he is thoroughly familiar with instructions and can properly treat and pack a journal box as outlined in the A.A.R. Lubrication Manual.

Car Kinks from the Indiana Harbor Belt

The service life of large stencils on the Indiana Harbor Belt has been increased from a maximum average of 50 cars to a consistent average of 380 cars. At the same time the more durable stencil does a far neater paint job by giving sharp solid painted lines with no unpainted spots and with no blurring around the edges. It further prevents destruction of the stencil from high winds.

These objectives are accomplished by wiring the different sections of the stencil together, rather than by joining them with small sections of the stencil paper left in place.

The wire is wound around nails and threaded in and out of the stencil paper every inch or two, except in small spaces, such as the "A" in the word "All" of the stencil shown in both of the illustrations. It enters the individual sections about ¾ in. from the edges so that the stencil paper will lie flat adjacent to the surface to be painted, and thereby aid in painting a sharp clear line. The wire is twisted across the openings between the sections to prevent relative movement between any of the sections. Two small strips of wood are fastened to the large center section for added rigidity.



Close-up of the wiring method to strengthen stencils, showing how the wire is twisted across the openings between the sections to hold them securely in proper relative position

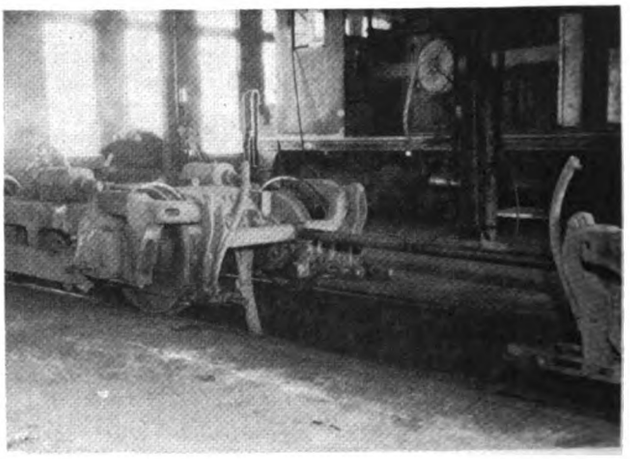
Handy Way to Move and Spot Trucks

The Gibson, Ind., shops moves and simultaneously spots the two trucks under a diesel locomotive by means of two slightly different connecting bars. One bar connects the switching locomotive to one of the trucks, and the second connects the trucks together. The latter bar is of such a length, varying between different locomotives, that, when applied between the trucks, the correct center-to-center distance between the trucks is automatically attained. Spotting is further facilitated by the rigid connections, with no slack of both of the bars.

The bar that extends between the trucks joins to each

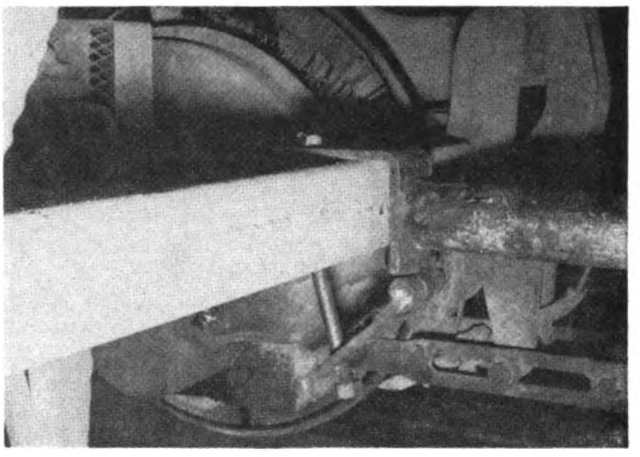


Wiring the sections of this stencil together has increased the service life eight times, eliminated damage from high winds, and given neater paint jobs



Trucks are both moved and spotted the proper distance apart under the locomotive by this spacing bar

The bottom of the U-shape end is hinged to simplify application of the bar to the trucks when the trucks are under the locomotive



truck through a U-shaped end hinged at the bottom. This hinging simplifies application of the bar when the trucks are under the locomotive; the bar can be laid in place, the bottom leg of the end raised to position, and the fastening completed by screwing the bolt into the nut welded on the top leg.

The bar that connects one of the trucks to the locomotive is similar, except that the U-shaped end which fastens to the locomotive is in one piece, not hinged. It connects to the locomotive by removing the coupler knuckle, and dropping the knuckle pin through the openings in the end of the bar.

Four Helps in Reclaiming Brasses

The four illustrations show some of the devices which the Missouri Pacific has found helpful in reclaiming journal brasses at Sedalia, Mo.

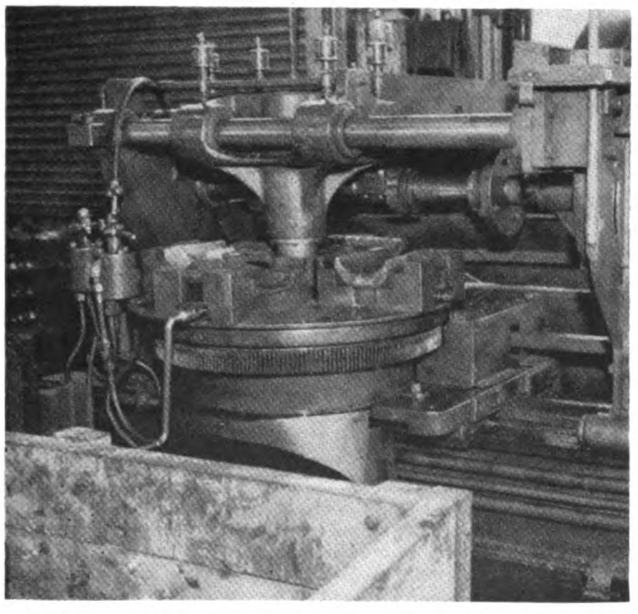
Fig. 1 shows a machine that is equally useful for the roughing out cut before rebabbitting or for the finishing cut after rebabbitting. In the first operation, the large face miller faces one end; then the journal is bored, and finally the other end is faced. The face millers for the ends are form cutters which cut to the correct length and to the proper radius. The machine has high uninterrupted production because it is loaded and unloaded from the foreground station at the same time that it is cutting at the rear station.

The machine in Fig. 2 for grinding the faces has a similar high production rate because it too is loaded and unloaded at the same time that it is doing its work. The table turns continuously during grinding, which is done by sectional stones. The brasses are clamped in place by the hinged levers, which lock under the ears on the table.

Fig. 3 shows a water-cooled mandrel for pouring the babbitt. The brass is quickly secured in place for pouring by the U-shaped spring clamp on top and by the bent bar on the side.

The layout for melting the old babbitt off the brasses is illustrated by Fig. 4. The brasses are put in at the left and are moved along the grate by a pusher driven by an electric motor through reduction gearing which moves the grates three times per minute. The molten babbitt

▼ Fig. 1—This machine is loaded and unloaded at the same time the brasses are bored and faced.



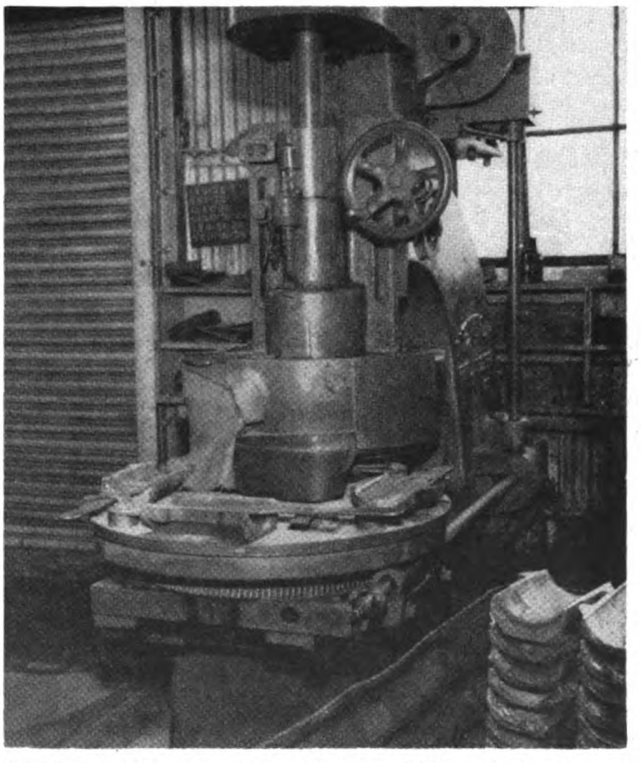
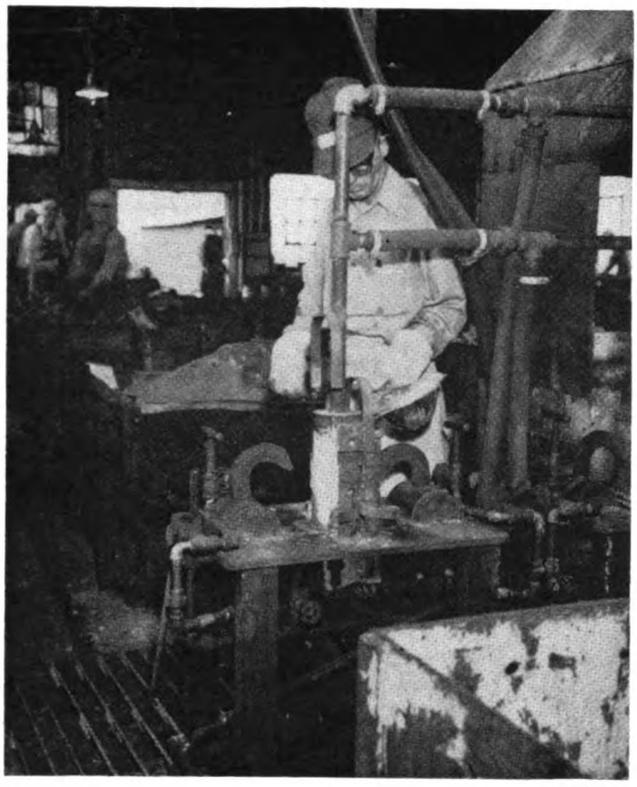


Fig. 2—Machine for uninterrupted grinding of the journal brass faces



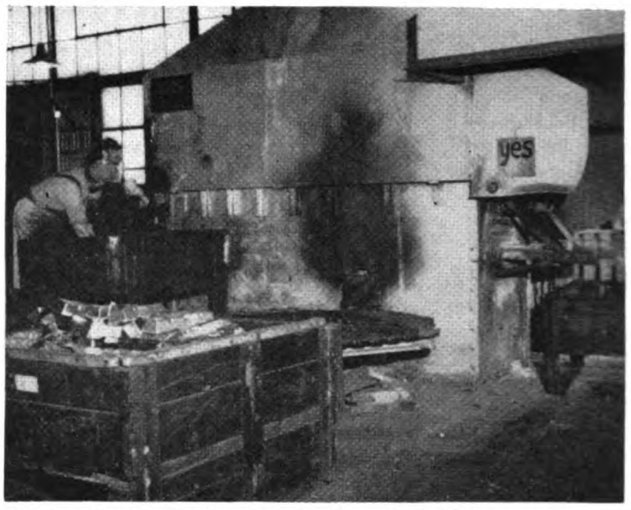
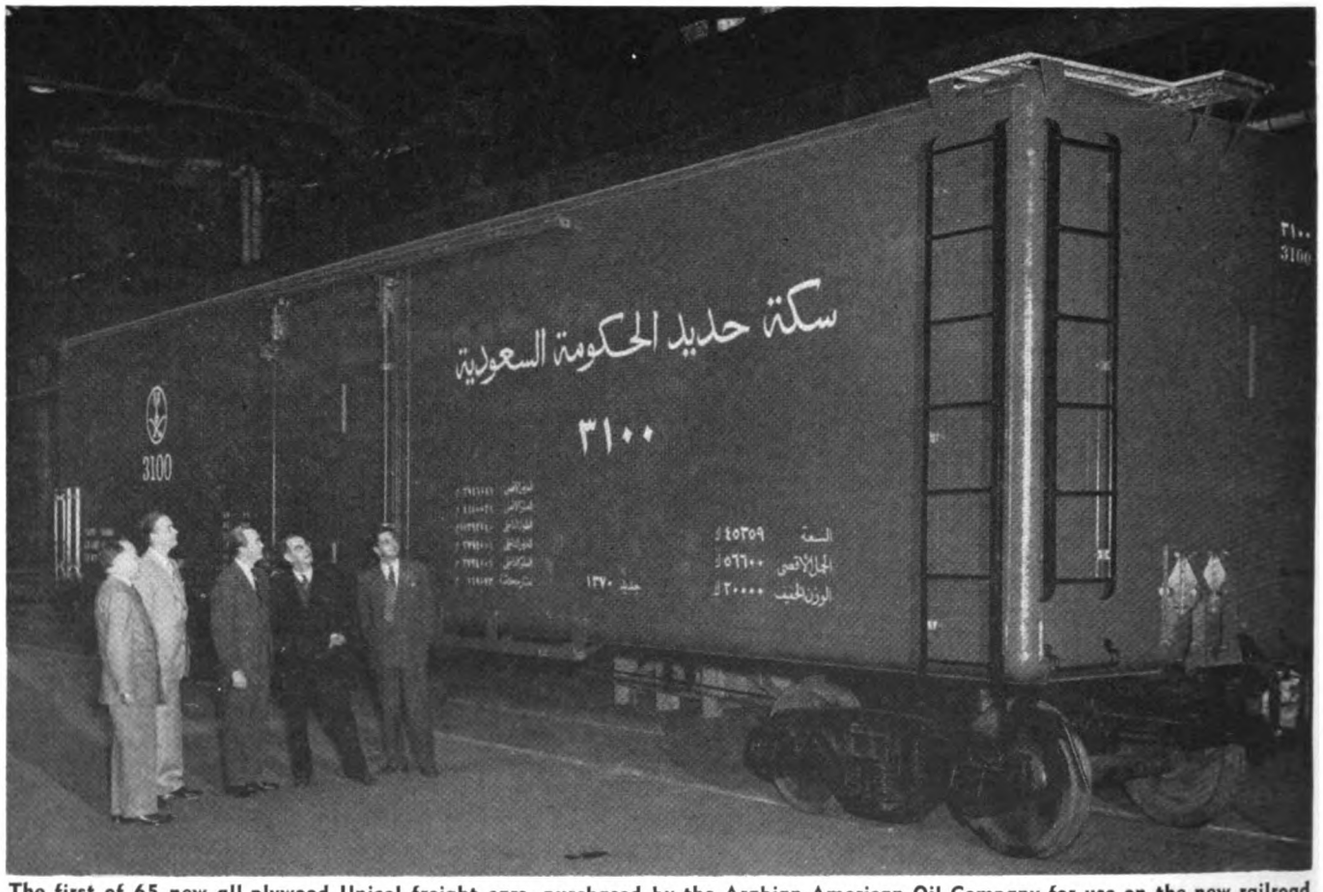


Fig. 4—Layout for melting the old babbitt

Fig. 3—Water-cooled mandrel with quick clamping arrangement for pouring the brasses

falls through the grates and is poured into the pigs from the spout a little to the right of the oven center. The brasses continue on, falling off the grates into the skid at the extreme right.

* * *



The first of 65 new all-plywood Unicel freight cars, purchased by the Arabian-American Oil Company for use on the new railroad which they are building in Saudi Arabia, rolls off the production line at Pressed Steel Car Company's plant at Hegewisch, Ill. Inspecting the car, and puzzling over the Arabic script (which reads, from right to left "Arabian-American Oil Company. 3100") are, left to right, F. Dale Campbell of Pressed Steel Car Company's export division; John J. Riordan, engineer for Arabian-American Oil Company; W. F. Wilmas, executive vice-president of Pressed Steel Car Company; Henry A. Ford of R. W. Hunt Company; and Bertrand Goldberg, designer of the Unicel car.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Turbosupercharger

317-Q.—What is the function of the turbosupercharger? A.—To provide supercharging of the diesel engine, all cylinders are charged with air above atmospheric pressure.

318-Q.—What is the advantage of supercharging? A.—The added air in each cylinder permits more fuel to be burned than would be the case if the cylinders were charged with atmospheric pressure only.

319-Q.—What comprises the turbosupercharger? A.—An exhaust gas powered turbine and a centrifugal air compressor mounted on a common rotor shaft.

320-Q.—Where does the power come from that operates the turbosupercharger? A.—Energy in the exhaust gas from the engine is recovered in the gas turbine to drive the centrifugal blower supplying air at supercharging pressure.

321-Q.—What eventually becomes of the exhaust gases? A.—The gases pass through the turbine on out through the gas outlet and expelled to atmosphere by means of an exhaust stack through the locomotive roof.

322-Q.—Approximately how much air pressure is developed? A.—Eighteen to twenty pounds.

323-Q.—How does the air get to the cylinders? A.—The air is drawn through a filter silencer by the compressor and is compressed after which it is directed through the air manifold to the engine cylinders.

324-Q.—What happens as the air enters the cylinders? A.—The air entering the cylinders, first scavenges the burnt gases and then charges the cylinders with clean air under pressure.

325-Q.—How is the air intake manifold formed? A.—By enclosing the *V* in the engine frame with sectional covers. Elbows, cast integral with these covers, conduct air to the individual cylinder heads. An expansion joint and elbow connect the compressor side of the turbosupercharger to the air manifold.

326-Q.—Describe the air intake filter and silencer. A.—The air intake filters and silencer assembled as a unit are bolted to the turbosupercharger air intake elbow and supported by a bracket from the locomotive roof.

327-Q.—How does the silencer perform its function? A.—By means of baffles and sound deadening material the air intake silencer muffles the noise created by the air rushing into the turbo supercharger.

Fuel Oil System

328-Q.—Where is the fuel supply tank located? A.—Beneath the underframe between the trucks.

329-Q.—What is the fuel tank capacity? A.—1,200 gal. on the road locomotive and 800 gal. on the road switcher.

330-Q.—With what are the tanks equipped? A.—(1) A sight glass gage to permit observation of the fuel level on the side of the tank; (2) Two vent pipes with flame arrestors; (3) Drain plugs for washout purposes and also a drain valve.

331-Q.—What type drain valve is used? A.—An inverted type held in place by a cap nut.

332-Q.—Describe the operation when draining the tank. A.—Remove the pipe plug in the side of the cap nut and then loosen the cap nut a few turns. This will allow the valve to drop from its seat and condensation drains through the hole in the cap nut. Tighten the cap nut and apply pipe plug.

333-Q.—What additional fuel level indicator is provided on the road locomotive? A.—Road locomotives are equipped with a remote gage which indicates the fuel level in the tank in gallons and inches and operates on 10 lbs. air pressure.

334-Q.—What precaution must be taken with the air supply valve? A.—It must be kept closed except when taking a reading.

335-Q.—Why is this necessary? In order to maintain gage accuracy and to prevent condensation from getting into the fuel tank.

336-Q.—What draws the fuel from the fuel supply tank? A.—An electric motor driven fuel oil booster pump.

337-Q.—What part of the fuel system is between the tank and booster pump? A.—It is known as the suction side.

338-Q.—When the oil leaves the tank, what must it pass through before it gets to the bottom pump? A.—All oil drawn from the tank must pass through the emergency fuel cut-off and fuel oil suction filter.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

Steam Locomotive Practice

By George M. Davis

Draft Gear Inspection Rules

Q.—Are the rules governing the maintenance and inspection of the drawbar connections between engine and tender of a steam locomotive applicable to the drawbar connections between the two units of a diesel locomotive?—M.F.R.

A.—The drawgear between the locomotive and tender, together with the pins and fastenings, shall be maintained in safe and suitable condition for service. The pins and drawbar shall be removed and carefully examined for defects not less frequently than once each three months. Suitable means for securing the drawbar pins in place shall be provided. Inverted drawbar pins shall be held in place by plate or stirrup, while drawbars and pins when used between units of diesel locomotives shall be removed

as often as conditions may require, but not less frequently than once every six months. When drawbars and pins are removed, they and their connections shall be carefully inspected for defects. Date of last removal and inspection shall be legibly stamped on the head of the pins and drawbars and all prior dates obliterated. Provisions shall be made for securing drawbar pins in place, and a plate or stirrup shall be provided under the lower end of all drawbar pins which will prevent the pin from falling out of place in case of breakage.

Alloy Steel in Rods

Q.—What are the advantages of using molybdenum steel for locomotive main and side rods?—P.F.R.

A.—Molybdenum steels used for locomotive main rods and side rods have sufficient hardenability to develop high fatigue resistance and improved service life under conditions of railroad service. One of the most important effects of molybdenum is its ability to reduce the effect of mass on the mechanical properties developed by heat treatment and to give fairly uniform properties even in very large sections. Molybdenum not only improves the room temperature properties but also strength at higher temperatures and the toughness at lower temperatures. Molybdenum steels with superior combinations of strength and toughness are used for lightweight reciprocating parts.

Molybdenum decreases the susceptibility of steels to temper brittleness resulting from heat treatment. Use of the proper amount of molybdenum, in a steel which would otherwise be embrittled by tempering in the range 850 to 1,100 deg. F. or cooling slowly through this range from a normalizing or annealing temperature, is a practical and economical way to avoid temper brittleness and improve the toughness and fatigue resistance of heat treated alloy steel forgings.

The mechanical properties of typical molybdenum steels used for main and side rods, normalized, quenched and tempered are as follows:

Tensile strength, p.s.i.	102,000
Yield point, p.s.i.	91,000
Elongation in two inches, percent	26
Reduction of area, percent	68
Tensile strength, p.s.i.	132,000
Yield point, p.s.i.	115,000
Elongation in two inches, percent	22
Reduction of area, percent	65

Cylinder Clearance

Q.—How is the cylinder clearance of a locomotive determined? What is meant by a six per cent cylinder clearance?—F.E.D.

A.—Cylinder clearance on a steam locomotive is the space between the piston, when at either extreme position, and the cylinder head. It includes all space bounded by these members, inside of the cylinder walls. It is measured by volume and is designated by its percentage to the total cylinder volume. A six per cent cylinder clearance means the volume of the space between the piston head, in extreme position, and the cylinder head is six per cent of the volume of the cylinder obtained by multiplying the area of the piston by its stroke.

Weight Distribution

Q.—Does the removal of the booster have any great effect on the weight distribution of a steam locomotive?—R.E.A.

A.—On a conventional modern 4-8-2 type freight locomotive having the booster removed from the trailer axle, and all other booster equipment and piping removed from the locomotive will result in the loss of spring borne weight of approximately 8,200 lb., with the center of gravity of the spring borne weight of the locomotive moving forward approximately five inches increasing the weight on the engine truck and reducing the weight on drivers. The general practice is to move the trailer equalizer pin forward a sufficient amount so that the weight on drivers will remain the same for the non-booster locomotive as it was on the booster equipped locomotive which results in the weight on the rear trailer wheels being reduced approximately the amount of weight of the booster equipment removed; with but little change to the weight on the engine truck. A typical example as to the effect the removal of the booster has on the weight distribution of a 4-8-2 locomotive is as follows:

	Engine Truck, lb.	Weight on Drivers, lb.	Trailer Truck, lb
Booster Equipped Locomotive	65,400	257,000	62,700
Non-Booster Equipped Locomotive—No change in Spring Rigging	69,800	247,100	59,000
Non-Booster Equipped Locomotive—Trailer Equalizer Pin moved four inches ahead (one hole)	63,800	258,700	53,400

Steam Locomotive Boilers

By George M. Davies

Should Holes Be Plugged?

Q.—When relocating the feed water pump boiler check from the side to the top of the boiler, is it satisfactory to plug the hole in the shell with a standard brass boiler plug?—M.E.K.

A.—As all openings over 3¼ in. in diameter and or exceeding 4½ times the thickness of the plate must be suitably reinforced and all screw plugs must have at least four full threads in the sheet which would no doubt require the application of a reinforcement plate at the check hole. It would be more practical to apply a suitable diamond shaped patch to permanently close the hole when relocating boiler check from side to top of boiler.

Forming a 40-in. Dome

Q.—When flanging a one-piece dome for a locomotive boiler using conventional ring and plunger dies, how many heats will be required to form a dome 40 in. diameter, and 12 in. high, using 1¼ in. thick plate?—V.M.F.

A.—The general practice is to use two heats of the material for domes up to a height of 12 in. high and three heats up to a height of 19 in. Beyond these heights the number of heats will vary from 5 to 7 up to a height of 30 in. This does not include the flanging of the dome base to the contour of the boiler shell.

Steam Generator Safety Valve

Q.—Is there any law or regulation which requires that the Safety Valve which is applied to the Steam Generator on diesel locomotives must have a lever?—R.G.M.

A.—Steam generators furnished by the diesel builders are built to the A.S.M.E. Code, the name plate on the generator is stamped with the A.S.M.E. Symbol and National Board or Hartford Steam Boiler Number assigned.

The A.S.M.E. code provides as follows:

Par.-282—"To insure the valve being free, each safety valve shall have a substantial lifting device by which the valve disk may be positively lifted from its seat when

there is at least 75 per cent of full working pressure on the boiler. The lifting device shall be such that it cannot lock or hold the valve disk in lifted position when the exterior lifting force is released."

The handles are applied to the safety valves to conform to this requirement of the A.S.M.E. Code.

The I.C.C. Bureau of Locomotive Inspection, Laws, Rules and Instructions for Inspection and Testing of Steam Locomotives and Tenders, for other than Steam Locomotives provides as follows: 316(a) "Every steam boiler shall be equipped with at least two safety valves and every hot water boiler shall be equipped with at least one water relief valve, the capacity of which shall be sufficient to prevent, under any condition of service, an accumulation of pressure of more than 5 pounds above the allowed working pressure. The safety valves shall be connected with the boiler independent of any other connection, and located as closely to the boiler as may be consistent without discharge inside of cab. Water relief valves may be mounted on the expansion tank of hot water boilers provided no valves are interposed between the expansion tank and the boiler. Sufficient clearance to prevent damage shall be provided where safety or relief valves or connections pass through cab structure."

The I.C.C. rules make no mention of the use of a substantial lifting device or handle to insure that the safety valves are free, however, it would appear that these appurtenances should be maintained in accordance with the A.S.M.E. Code to conform the stamping on the steam generators.

Any change in the number, size, make and style of safety valves as shown in the original specification, filed with the I.C.C. must be reported by filing an alteration report.

Inside Shell Patches

Q.—What are the objections to applying a patch on the inside of the shell, when the locomotive is in for classified repairs with the tubes and flues removed?—F.E.L.

A.—Patches should not be applied to the inside of the shell to cover defects such as corrosion as the patch would cover the corroded area and thus prevent future inspection of the corroded area, without removing the patch, Also, patches applied to the inside of the shell to reinforce cracks would not permit caulking along the edge of the patch, in the event of a leak, without removing the tubes and flues.

Schedule 24 RL
Air Brakes

Train Control Operation

1201-Q.—When operating the electro-pneumatic brake, how is a temporary suppression obtained?

A.—By making a moderate application.

1202-Q.—Explain the flow of air to cause a temporary suppression.

A.—Air from the straight air pipe enters the A-1 suppression valve at connection *28* and flows against double check valve *16* and into passage chamber *A* to close cut-off valve *80* and cause a temporary suppression.

1203-Q.—What other flow of air from the straight air pipe occurs?

A.—Air from the straight air pipe also flows through choke *44* under return diaphragm *49* to passage *37* and straight air suppression timing reservoir.

1204-Q.—What will eventually result from this flow of air?

A.—A train control application will occur unless a heavier straight air application is made.

1205-Q.—What will bring about a train control application in the event that a heavier application has not been made?

A.—Pressure will increase in chamber *E*, diaphragm *49*, and in a predetermined time will overcome forces holding cut-off valve *80* closed, and permit it to re-open causing a train control application.

1206-Q.—How much air is required in the straight air pipe in order to bring about a permanent suppression?

A.—About 45 lbs.

1207-Q.—How is a permanent suppression obtained?

A.—Pressures in chambers *E* and *A* will cause a collapse of suppression spring *29* and the area of diaphragm *57* being greater than diaphragm *49*, will hold the assembly to the right and cut-off valve *80* remains closed.

Changing Ends (Two Diesel A Power Units)

1208-Q.—When changing ends on double end "A" equipment (Two A Units), what must first be done?

A—Make a 20-lb. brake pipe reduction with the automatic brake valve and place it in Lap position.

1209-Q.—What next should be done?

A.—Move the independent brake valve handle to release position and observe if the brakes are still applied.

1210-Q.—What action should then be taken?

A.—Close the brake pipe cut-out cock place K-2 rotair valve in Lap position or the K 2-A rotair valve in "FRGT" or "PASS" Lap. Move automatic brake valve handle to Running position and remove both handles.

1211-Q.—What is done to assume control at the other end?

A.—First, insert the brake valve handles, place rotair valve on "PASS" position, move independent brake valve handle to application position. Open the brake pipe cutout cock and move the automatic brake valve handle to emergency position and then back to Lap.

1212-Q.—When changing pressures, what should be done to avoid the possibility of an overcharge?

A.—Depress the independent brake valve handle in full application position for about eight seconds.

1213-Q.—What is finally done to assume control?

A.—Move automatic brake valve handle to running or release position. Position rotair valve for service desired (either "PASS" or "FRGT"), depress foot pedal, check gages to insure brake pipe and main reservoirs are fully charged, then release independent brake.

Hauling Locomotive A Unit Dead in Train

1214-Q.—What preparation should be made at the brake valve for an A unit to be hauled dead in a train?

A.—Close the brake pipe cut-out cock and remove the brake valve handle (in running position). Move shifter lever if included to A.U. position.

1215-Q.—What other changes should be made?

A.—Open the dead engine cock (or change the dead engine cap).

1216-Q.—Where is the dead engine cap located?

A.—On the control valve pipe bracket just above the service portion.

1217-Q.—What does this provide for?

A.—Provides for charging the main reservoir from the brake pipe.

1218-Q.—What should finally be done?

A.—Open the brake pipe branch pipe cock to charge the D-24 control valve reservoirs. Remove or keep the independent brake valve handle in release position. Position rotair valve in passenger (PASS) position.

ELECTRICAL SECTION

Freon Compressor for Air-Conditioning Maintenance

Charging and evacuating air-conditioning systems is facilitated by portable unit developed in Los Angeles General Shops of the Southern Pacific

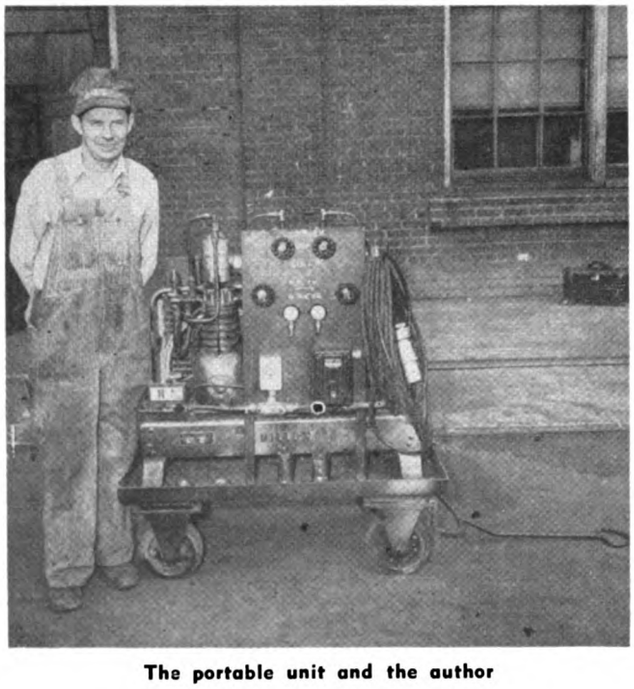
*By Walter Kaysen**

THE PORTABLE unit shown in the illustrations includes a motor-driven compressor, condenser, dehydrator, trap and the valves and piping necessary to use it both for charging and evacuating freon gas used in air-conditioning systems. It was developed by the author, under the supervision of A. E. Lines, departmental foreman of electricians.

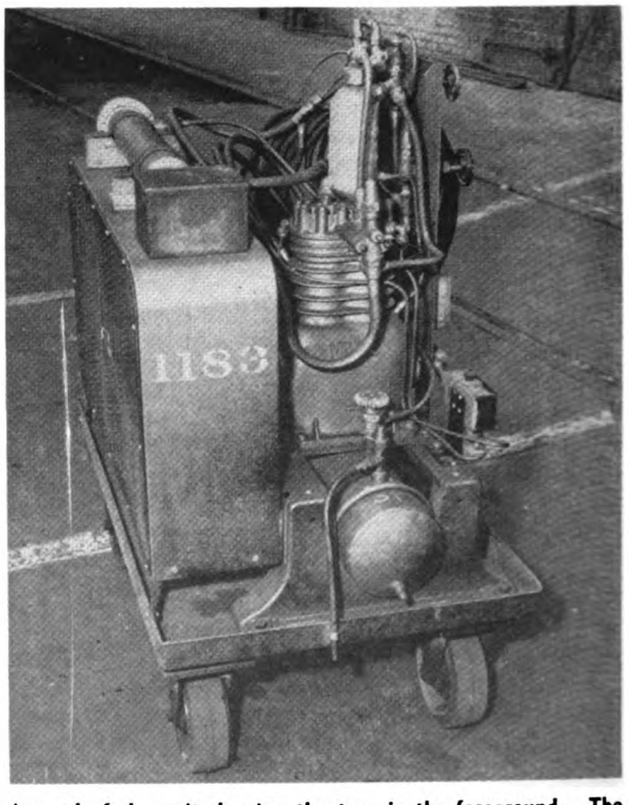
To pump down a car unit, the hose *H* (see diagram), is connected to an empty refrigerant tank. The hose *I* is connected to the high side of the compressor unit to be pumped down. If the unit has been removed from the car, the hose is connected to the high-side car connector with a quick-detachable adapter. For pumping gas from the car after the air conditioning unit has been removed, the portable compressor is connected to the high side with the proper adapter.

The procedure is as follows: Open the two valves at the top of the control panel. These are the valves marked *C* and *D* in the diagram. Open the valves *T1* and *T2* on

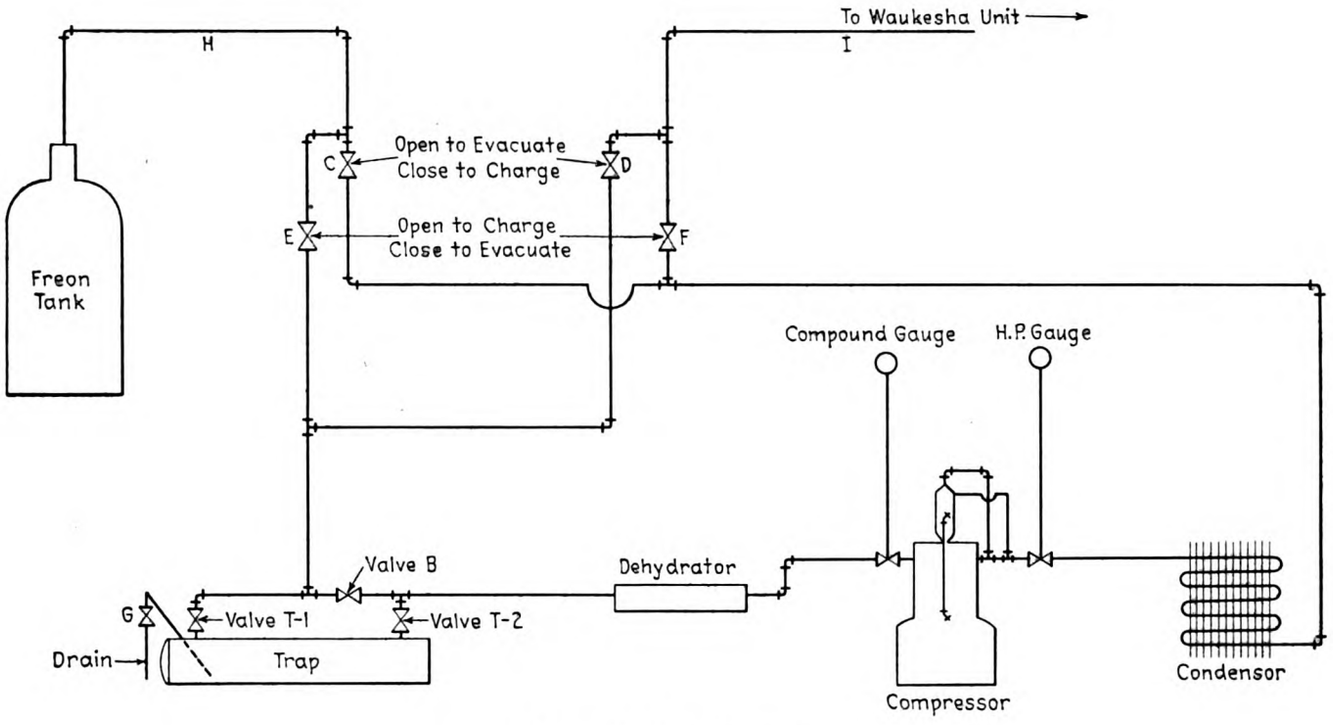
* Electrician, Los Angeles General Shops, Southern Pacific Company, Los Angeles, Cal.



The portable unit and the author



An end of the unit showing the trap in the foreground.—The dehydrator is at the upper left and the motor and V-belt drive is in the screened housing at the left



Schematic piping diagram

the oil trap tank. Close valve *B*. Then close the two lower valves on the upper panel. These are the valves *E* and *F* on the diagram. Open the high-side valve on the unit being pumped down. Bleed off air to the refrigerant tank. Open the tank valve. Start the compressor on the portable unit by means of the manual switch. If the attendant must leave the unit before the operation is complete, place the switch in the automatic position.

After the air conditioning unit or car has been pumped down, and everything disconnected, open the valve G on the oil trap tank and blow out any oil or dirt which may have accumulated. This oil trap tank is not being used as a receiver in the normal way, but rather as an oil and dirt trap.

To charge a unit on a car, the procedure is as follows: Connect the portable unit to the compressor on the car as in the case of pumping-down. Arrange valves as for pumping-down. Leave the tank hose disconnected and run the portable compressor until the air has been evacuated from the system which is to be charged. Run until a good vacuum is established and no air comes from the hose.

Connect the hose to the refrigerant tank and close the two upper valves, *C* and *D*. Open the two lower valves, *E* and *F*, and also open the valve *B*. Close the valves, *T1* and *T2*, and start the compressor on the portable unit, either on manual or automatic.

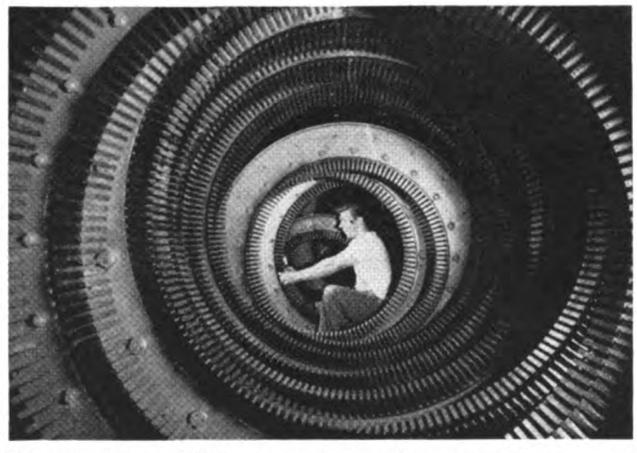
Lay the refrigerant tank down on its side. After 10 or 15 lb. pressure is built up in the system, stop the compressor. Test the car system for leaks with Halide lamp in the usual manner, and proceed with charging after repairing leaks if necessary.

The portable unit filters the refrigerant as it is removed from the car and only clean refrigerant is stored in the tank. While a system is being charged, the filter trap is by-passed. The Silica Gel in the dehydrator should be changed occasionally.

When a system is being charged and leaks are found, the refrigerant in the system can be removed by arranging the valves for this purpose. This can be done without changing the hose hook-up.

The pressure switch on the pump unit is set to shut off at 0 lb. pressure and to start at 10 lb. pressure. If the high-side pressure builds up to 190 lb., the compressor will stop.

The small tank mounted on top of the compressor is an oil trap which protects the compressor from losing its charge of oil. On top of the trap is a filter of Poronze which should be cleaned occasionally.



Round and round he goes, and when he stops, this inspector will have completed examining a line-up of synchronous motor stator frames at General Electric's Large Motor and Generator department, Schenectady, N. Y. Rated 100 hp. to 500 hp., these motors will be used to drive pumps, compressors, hoists, conveyors, generators, fans and other equipment

Tester for G. E. Engine Governors

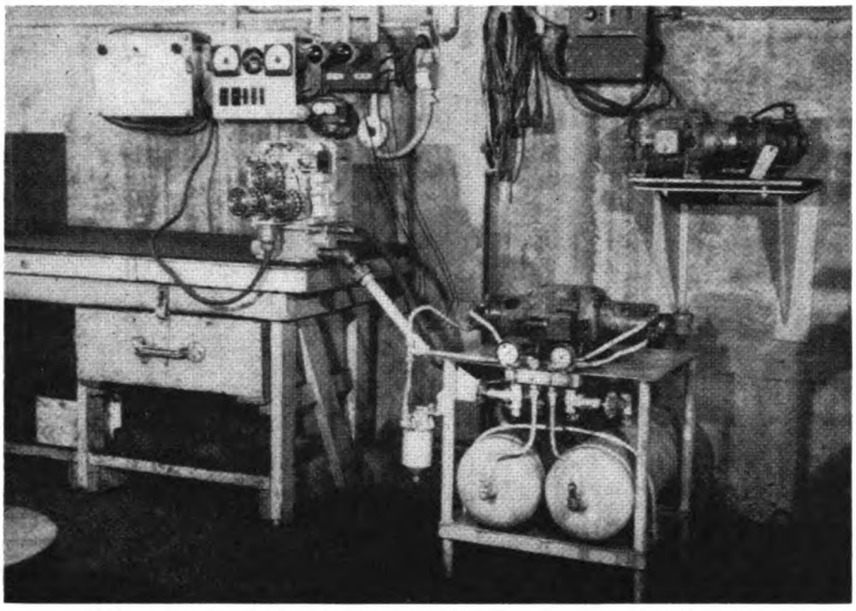


Fig. 1—General view of the governor testing equipment

Testing equipment for General Electric diesel locomotive engine governors developed in the Marion, Ohio shops of the Erie is shown in the three illustrations.

The governor to be tested is placed on the bench as shown in Figs. 1 and 2. The oil pressure required for governor operation is supplied by the motor-driven pump shown on the stand at the right of the bench in Fig. 1. This is the same type of pump used on the locomotive.

A cable and plug connection like that on the locomotive (see Fig. 2), is used to connect the governor electrical circuits to the test panels above the bench. Figure 3 shows these panels in detail.

The meters on the right-hand panel are respectively an 0-500 d.c. milliameter, an 0-100 d.c. voltmeter, and an 0-100 d.c. ammeter. Power for testing is furnished by a motor-generator set. This power operates the motor which drives the oil pump and the voltage as shown by the voltmeter is maintained at 72. On the left-hand (test) panel are various adjustable and fixed resistances for making various tests.

The speed pilot valve is shown at the upper right corner of the governor. This is tested by means of the adjustable rheostat shown in the upper left corner of the test panel. This rheostat is used to adjust the resistance in the speed pilot valve circuit to a point at which

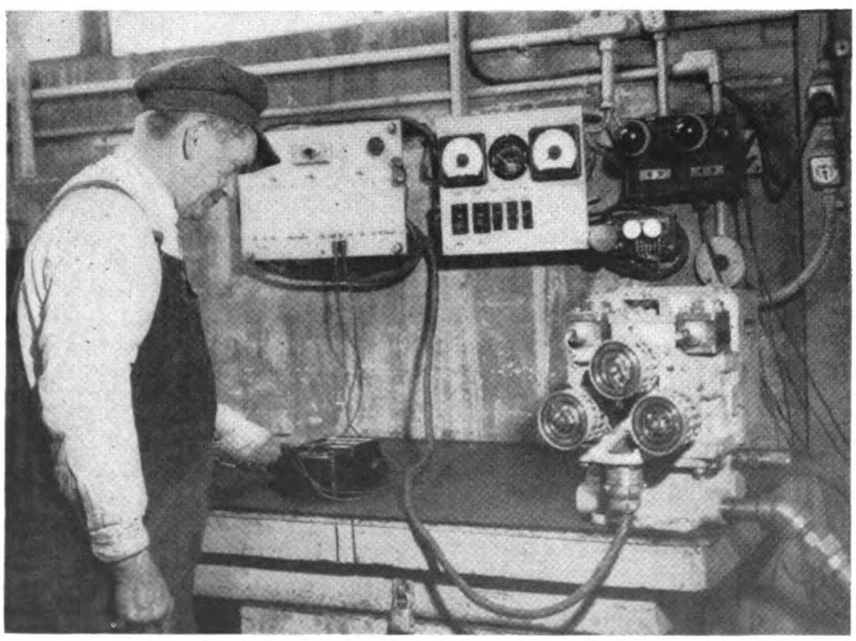


Fig. 2—H. Dixon who developed the testing equipment making resistance tests with a Simpson battery-powered ohmmeter

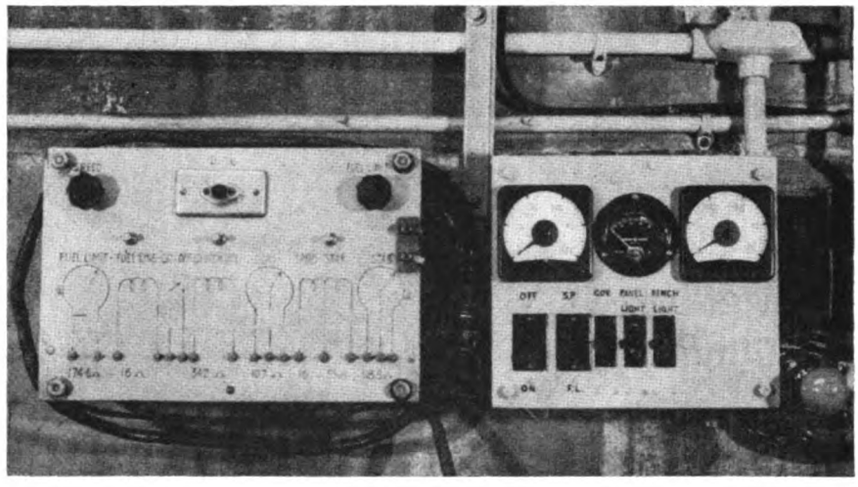


Fig. 3—The test panel at the left and meter panel at the right

the pilot valve is balanced. This will occur when the milliameter shows .475 amp. if the valve spring tension is correct.

The fuel limit valve (upper left on the governor) is tested in the same manner by means of the rheostat in the upper right-hand corner of the test panel.

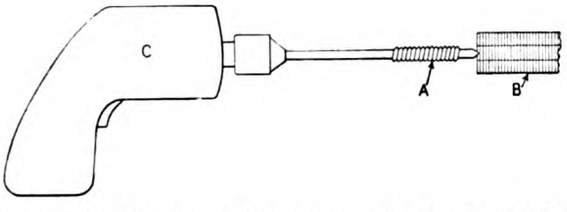
The push button in the upper center of the test panel energizes the stabilizing coil in the speed pilot valve, and admits oil to the slave piston which brings the *A* an *B* arms of the governor together. Toggle switches at the left and right are in the corresponding rheostat circuits.

The lower connections on the test panel under the diagrams are connections for a battery-operated ohmmeter. With the ohmmeter connected across the respective terminals, it is used to measure the resistance of coils and potentiometers. The readings which the ohmmeter should show if all resistances are correct are shown between each pair of terminals. Reading from left to right, they are as follows:

Fuel limit potentiometer	174	ohms
Coil of fuel limit pilot valve	16	ohms
Clutch coil	342	ohms
Load potentiometer	10.7	ohms
Speed coil of speed pilot valve	16	ohms
Stabilizing coil in speed pilot valve	55	ohms
Stabilizing potentiometer	118	ohms

Cleaning Armature Slots

The best way to clean armature core slots before rewinding is by means of a flexible steel rod about eight in. long, which has a serving of coarse string on it. This is shown in the sketch. This is mounted in, and rotated by an electric drill. The advantage of this method of cleaning is that no metal dust is produced and it is impossible to burr the laminations over. Improper cleaning of the slots before rewinding often causes core heating due to eddy currents. The cause of this is conducting dust being left in the slots or the laminations burned over. It is often found that armatures run hotter after a rewind.



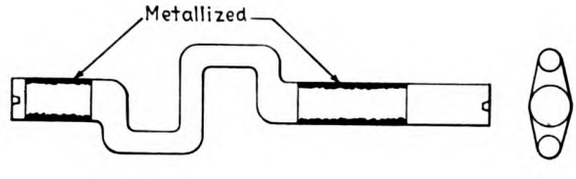
***A* is a serving of coarse string on a rod in the chuck of the electric drill (C) as used to clean core slots**

W. E. WARNER
Woodford Green, Essex, England

Armature Press Repaired With Metal Spray

By Michael Axler

We have a 40-ton press that we use for applying or removing shafts, commutators and laminations on our traction motors. After years of service, the shaft and the



main crankshaft bearings of the press pump became so worn that it interfered with operation of the press. It was easy to close in and scrape the bearings, but the shaft was a problem.

No parts were available since the press was over 30 years old. A new shaft could be made at a price of $241.00, but it could not be delivered within three months, and something had to be done at once.

The shaft is 5 ft. long, 5 in. in diameter, and has two throws. It is made of gray iron and preheating would probably cause warping. Brazing was also not practicable.

It was finally decided that it could be restored by metallizing. The worn sections were first turned with a 60-deg. thread cutting tool with 16 threads per inch.

This operation was performed in 15 minutes, after which the worn sections were metallized with bronze wire, this operation requiring 1 hr. and 23 min. The shaft was then turned to size in 22 min., making 2 hr. for the complete job. The total cost, including labor, metal used, and overhead was $13.50 The most important factor was that the press was idle only a few hours.

Insulating Field Coils By Filling Frame

About two years ago, the Great Northern developed a device by means of which traction motor field coils are insulated by filling the motor frame with insulating varnish. Experience has proved the method to be satisfactory and its use will be extended.

The device, as shown in the illustrations, incorporates a rectangular varnish tank, most of which is below the floor level. Projecting from the top of the tank is a cylinder or plug which has the same diameter as an armature. The purpose of this cylinder is to reduce the amount of varnish used to fill the frame.

When a set of coils are to be insulated, the frame is lowered down over the cylinder as shown in Fig. 1. Around the base of the cylinder is a neoprene gasket which fits tightly against the baffle between the field coils and the pinion-end bore when the frame is lowered to the position shown in Fig. 2.

The motor-driven pump shown in front of the device is then used to pump varnish from the rectangular storage tank into the space around the coils between the cylinder and the frame. Sterling R651 varnish is used for this purpose. It is pumped up until it fills the frame, and is allowed to remain for an hour or until all bubling stops. A drain valve, operated from the top of the cylinder is then used to open a drain at the lower edge of the cylinder, and allow the varnish to drain back into the tank. Drain holes in the top surface of the tank allow any varnish which gets past the gasket to drain back into the tank.

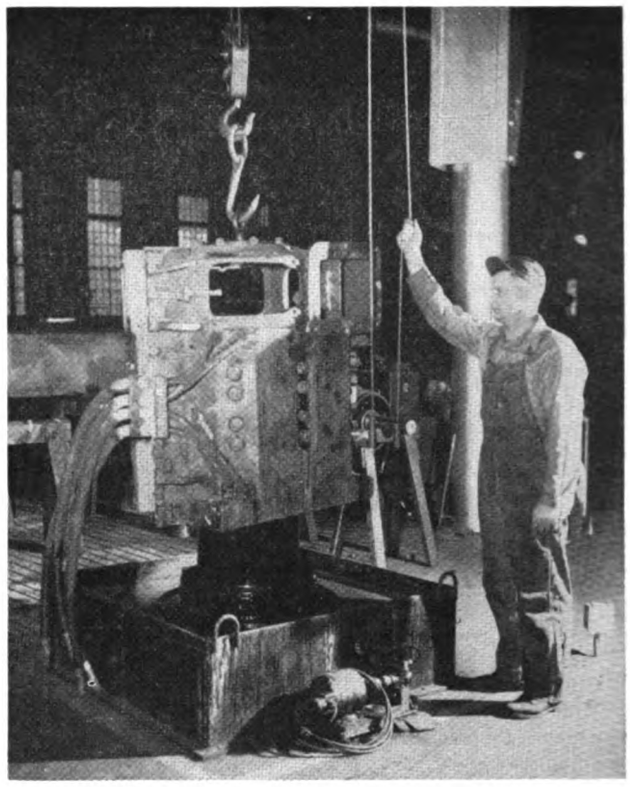


Fig. 1—A field frame being lowered into place for insulating

An overflow near the top of the cylinder protects against overfilling. Such varnish as may leak past the neoprene gasket, and adhere to the frame, is removed from machined fits with varnish remover.

It is now done with D7 and D17 frames, and a new adapter and seal will be made for D27 motors. Another machine is planned for generator frames.

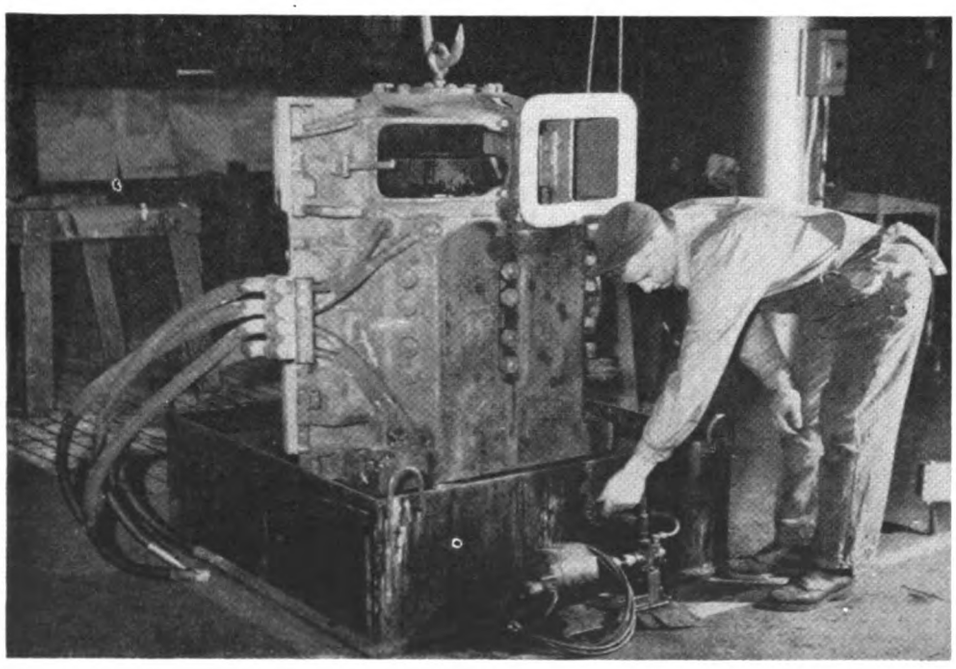


Fig. 2—With the frame resting on the seal, the operator starts the varnish pump

DIESEL-ELECTRICS—How to Keep 'Em Rolling

4 Running Maintenance of Commutators*

Resurfacing of a commutators requires know-how in order to insure good commutation and long life

"Face-Lifting" or Resurfacing

Commutator troubles may often be corrected by resurfacing. This is the name given to any process which restores a true, cylindrical, polished surface to the commutator.

Polishing.—If the commutator surface is merely smudged, you can clean it by polishing with canvas. When this is not sufficient, crocus cloth or fine (No. 4/0) sandpaper may be used. This should be mounted on a block curved to fit the surface of the commutator.

Stoning.—When only a small amount of copper has to be removed to correct the defect, a hand stone is most suitable. It should have a surface curved to fit the commutator. Also, it should be long enough to bridge the defect to be removed. Otherwise, the stone rides in and

* This is Part II of the 4th of a series of articles on maintenance of diesel-electrical equipment. This article is written by J. W. Teker and J. R. Schrecongost, both of the Motor Engineering Division, General Electric Company, Erie, Pa. Part I on the subject of commutator maintenance appears in the October, 1951 issue of *Railway Mechanical and Electrical Engineer.*

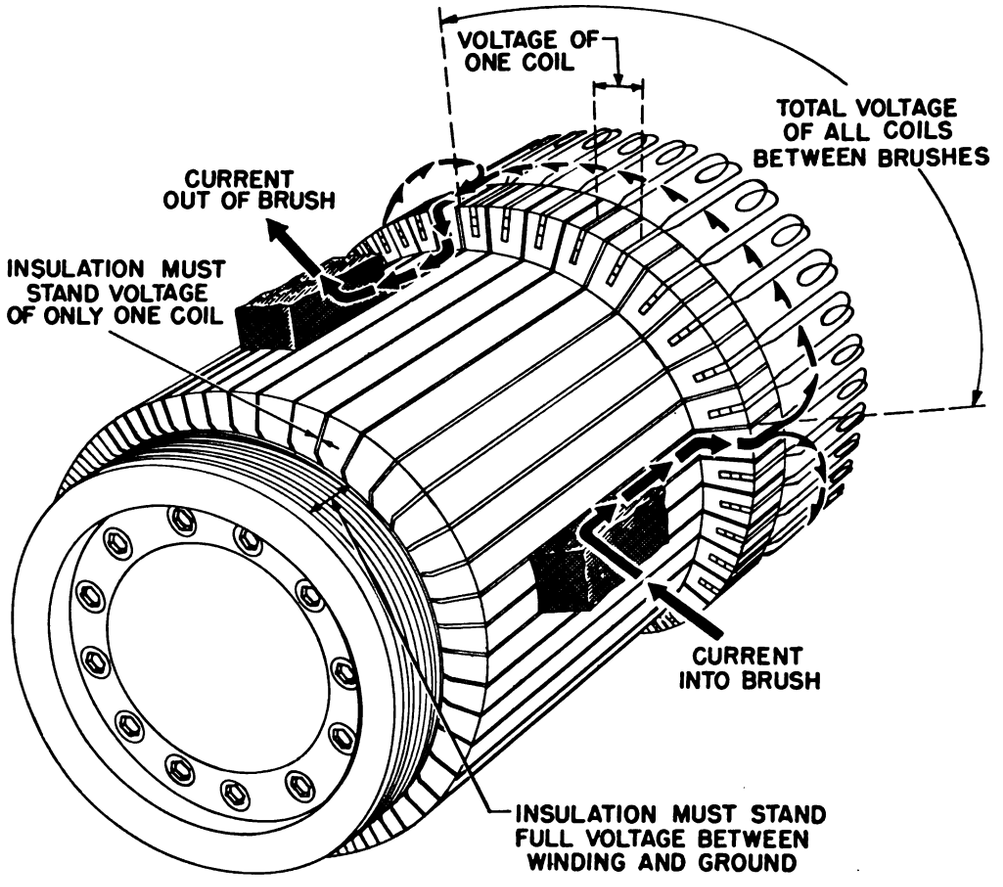


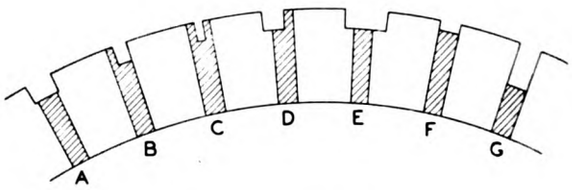
Fig. 2—The commutator must act as a reversing switch changing the alternating currents developed in the armature to the direct current in the exterior circuits

out of the defect and does nothing to correct it. The length of the stone will usually be limited by the space between brush holders. If this is not enough, a holder should be removed to make room for a larger stone.

When a greater amount of copper is to be removed, or the defect is too large to be bridged by the stone; use a jig, mounted on the frame of the machine to hold the stone. This jig has a movable carriage for passing the stone back and forth across the commutator. A feeding device regulates the position of the stone so that it cuts down the high spots on the surface. Jig stoning is faster and requires less skill than hand stoning. It also has the advantage that it will correct a commutator that is eccentric or out of round.

Turning.—If a commutator is badly worn or burned. the resurfacing operation can be speeded up by turning. A tungsten-carbide tipped lathe tool should be used because the speed may burn a tool-steel tip. Remove only enough copper to give a uniform surface. This cut should be followed by a coarse stoning and then a finish polish.

At times it may be necessary to remove the armature and turn the commutator in a lathe. When this is done, the armature should be supported on its own bearings if possible. If it cannot be supported on its own bearings, it must be held in lathe centers, but make sure they are



A. MICA PROPERLY UNDERCUT.
B. UNDERCUTTING TOOL TOO NARROW, LEAVING FIN AT ONE SIDE OF SLOT.
C. UNDERCUTTING TOOL VERY NARROW, LEAVING FINS AT BOTH SIDES OF SLOT.
D. SLOT IMPROPERLY INDEXED, PART OF BAR CUT AWAY AND FIN OF MICA LEFT.
E. TOOL TOO WIDE, PART OF BAR CUT AWAY ALSO.
F. UNDERCUTTING TOO SHALLOW, SHORTENS SERVICE LIFE BEFORE NEXT UNDERCUTTING.
G. UNDERCUTTING TOO DEEP, POCKET COLLECTS CARBON AND COPPER DUST, SHORT-CIRCUITING BARS.

Fig. 8—Some common mistakes in undercutting the mica between the commutator bars

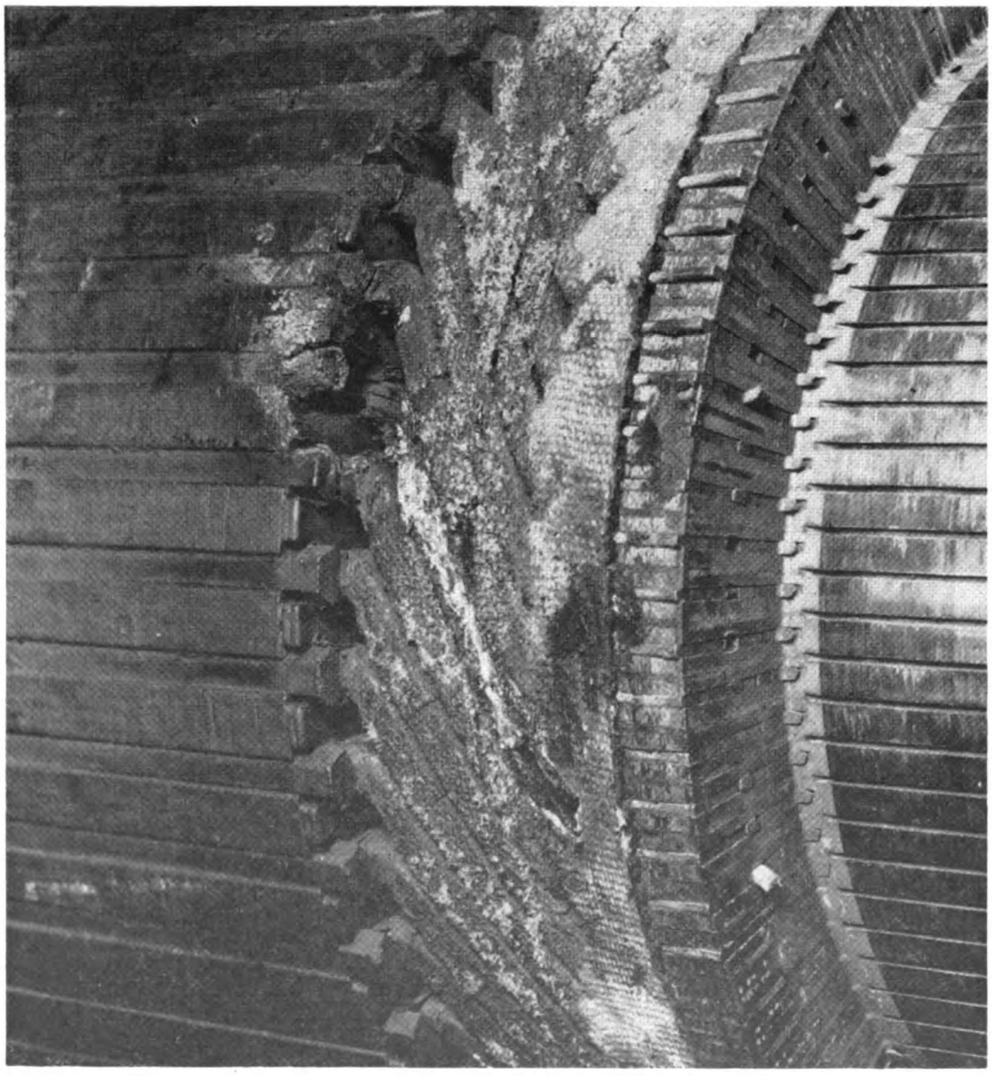


Fig. 9—An example of how molten solder has allowed the leads to shift and has short-circuited the armature coils by collecting under the insulation

true with respect to the bearing seats—otherwise you will end up with an eccentric commutator.

Undercutting.—After a commutator has been resurfaced, check the depth of the undercutting of the mica between bars. If undercutting is necessary, it should be carefully done with the proper tool. Some common mistakes are shown on Fig. 8. Be careful to avoid these. Make sure that no fins of mica project as shown in Fig. 8B, C or D. They will spoil the brush contact on an otherwise good surface.

Air Curing.—Resurfacing usually leaves particles and slivers of copper hanging on the bar edges or lodged in the undercut. These must be removed before the machine is placed in service. Otherwise, they may shift and bridge the side mica, causing a flashover. A special tool or a stiff brush may be used for this job.

After raking and brushing out between bars, the job should be checked by operating the machine at no load. Start out with a low voltage. Sweep a strong jet of compressed air back and forth across the commutator surface midway between the brush holders. The voltage and the air stream act together to disturb and burn loose any copper particles remaining in the slots, and to blow them out. When sparking under the air jet stops, increase the voltage another step. Repeat until top voltage is reached.

This process is called air curing. It can be done easily with a generator by blocking open the power contactors and increasing the speed a notch at a time.

In order to check a motor commutator at full voltage. you must arrange to have the field separately excited. This is necessary to keep the motor from running away at no load and full voltage.

Safety Precautions.—When working on commutators. always wear goggles and gloves as a protection against flying particles, and possible flashover when air curing. A respirator also should be worn during stoning operations to avoid breathing abrasive dust.

Stoning a commutator with the brushes in place will wear them away very rapidly and cause carbon dust deposits on insulation. When working on an engine-driven generator, the brushes that are hard to reach should be removed before the engine is started. After cranking, the rest of the brushes should be taken out. In the case of motors, the good brushes should be removed, and worn ones substituted. Usually one brush in each holder is enough to run the motor light.

Brush holders.—After resurfacing a commutator you should check the height of the brush holders above its surface. If much copper has been removed, you may have to lower them to meet the new surface level. When the holders are too high, the brushes will be cramped and cause trouble by sticking.

Switching Duty or Commutation

We have already seen that the second duty of a commutator is to act as a reversing switch. Just as mechanical defects in the commutator surface interfere with proper brush contact, so electrical defects in the machine will interfere with proper switching action. Now let's look at some of these.

1. Reversed main or commutating field coils.
2. The use of improper shims under pole pieces.
3. The exchange of magnetic for non-magnetic pole-piece bolts, or vice versa.
4. Wrong location of brushes on the commutator.

All these defects will cause sparking at the brushes and overheating. You are most likely to find them after a hasty emergency repair job on the equipment.

Anything that breaks the connection between a commutator bar and its armature coil will affect commutation. This happens when the commutator gets hot enough to melt the solder and allow the ends of the coils to lift out of the riser slots. Such heating may be caused by overloads or lack of cooling air. Hence, solder throwing warns the maintainer to check the blowers and air ducts to be sure that the machine is getting enough cooling air.

A connection not properly soldered, or one that has thrown solder, may oxidize rather than lift out of the risers. When this happens, local heating will cause a blackened or burned area on the riser at the poor connection.

Molten solder can cause serious damage. An example of this is shown in Fig. 9. Here the molten solder, not only allowed the leads to lift, but also short circuited the armature coils by collecting under the insulation.

Insulation

The purpose of insulation is to prevent leakage of the electric current. If leakage occurs across a small area of insulation, it may cause sufficient heat to carbonize the surface. This lowers the resistance enough to cause a breakdown.

Looking at Fig. 2, we see that each pair of commutator bars has the voltage of one armature coil between them. If the side mica is bridged by any conducting material, the bars will be short-circuited. The current flowing across this small area will heat the mica, causing it to carbonize and glow at that spot. At high speed and voltage, this hot spot will form a ring of fire around the commutator which may cause a flashover.

Another cause of short circuits is damage to the commutator, resulting from an accident. Loose objects, such as small bolts, nuts or washers may fall unnoticed into an air duct or a commutator chamber. If such material lodges between a brush holder and the commutator, it will do extensive damage and put the machine out of service.

Not only must the bars be insulated from each other, but the whole commutator must also be insulated from the ground. This insulation has to stand the full operating voltage of the machine. It consists of relatively long creeping surfaces next to the commutator. The string band, shown in Fig. 2, is one example. When these surfaces become coated with dirt or moisture, they are no longer good insulators. As a result, there is leakage of the current to ground. When this leakage becomes great enough, the insulation breaks down and a ground results. Such failures can be prevented by keeping the string band clean.

A flashover may strike across the string band and do varying amounts of damage. If the band is only smoked up, it can be cleaned with a cloth and solvent. If the paint is burned, it can be cleaned with sandpaper and repainted. Be careful not to cut through the string. If it is seriously damaged, a new band must be applied. This is a repair job.

By watching for the warning signs described above, an alert maintainer will be able to correct troubles before costly failures result. The old proverb says, "A stitch in time saves nine", and it is certainly true of commutators. A good job of preventive maintenance will pay big dividends in increased locomotive availability and decreased repair bills.

Automotive and Electric Rolling Stock

The report of the Electrical Section, Mechanical Division, Committee on Automotive and Electric Rolling Stock was presented at a joint meeting of the Electrical Sections and the Locomotive Maintenance Officers' Association at the Annual Meeting of these organizations held in the Hotel Sherman in Chicago, September 17-19, 1951. The report was presented by Committee Chairman C. A. Wilson, assistant general supervisor, diesel engines, Atchison, Topeka & Santa Fe.

The first section of the report describes new developments in motive power with electric drive. These have been described previously in *Railway Mechanical and Electrical Engineer.*

In presenting the second section of the report on standardization of electrical features of diesel locomotives, which deals with connectors for disconnecting and connecting all four traction motor leads at once, W. S. H. Hamilton (N. Y. C.) said such a device would be of great benefit to the industry. He said tentative drawings for such a connector had been made.

Sections of the report on diesel-electric locomotives for humping service and characteristics of dynamic braking were presented by L. S. Billau, electrical engineer, Baltimore & Ohio. The latter section, which is a description of dynamic braking characteristics contains this admonition:

The braking force obtainable by dynamic braking is definitely limited by four factors. In the first place, the current which may be passed through the motor field coils in order to cause the motor to generate voltage must be kept within the current rating of these coils in order to insure against overheating. Secondly, the current output of the traction motor armature must be restricted to its current rating for the same reason. A third and very important factor is that the voltage generated must not exceed a value which can safely be impressed upon the equipment. The fourth limitation arises from the electrical design, because sparking and possible flashing occurs at the commutator if high current values are passed between the commutator and brushes when the armature rotates at high speeds.

It is concluded as follows:

Dynamic braking is a very useful by-product of electric traction and where the initial cost and maintenance are justified can well prove its worth. It is not a substitute for the conventional air brake system but may be considered a very valuable adjunct to it.

The section on humping service, which is a summation of railroad practices follows.

Diesel-Electric Locomotives For Humping Service

The requirements of a diesel-electric locomotive designed for humping service are:

1—High starting tractive effort.

2—High continuous tractive effort at very low speeds.

3—Low horsepower output.

At the present time standard switching locomotives are largely used in humping service but their characteristics are not well adapted for this purpose due to necessity for operating under reduced throttle to maintain the very low speeds required at times which operation considerably reduces the capacity of the motors due to reduced blower operation. Tests recently made of a 2000 hp., six motor locomotive operating in humping service showed an average output of less than 500 horsepower.

At present there does not seem to be sufficient demand to justify designing locomotives suitable for humping service only as their lack of flexibility and low horsepower output make them unsatisfactory for other operations.

To meet these conditions two general types of locomotives are in use to some extent. Standard heavy duty six motor locomotives are available with special control to permit low speel operation at relatively high engine speeds.

There are also in operation a few locomotives consisting of a standard switching locomotive with control arranged for operation with a separate booster or trailer unit which latter is equipped with motors only and necessary accessories in way of control, blowers, etc. Such a combination has the advantage of providing a locomotive of the desired characteristics for humping service and when not required for this operation the booster unit can be disconnected. Booster units of this type can be built at a much lower cost than a standard locomotive. Also their maintenance cost should be much lower.

Some railroads have built their own booster units converting obsolete electric locomotives in which the motors and running gear only are utilized and equipping them with the necessary blowers, control, etc.

In considering the use of equipment of this character it is essential that the traction motors have the same general capacity and characteristics of the motors on the switching locomotives which information should be developed with the manufacturers of the electrical equipment. This is very essential since in general traction motors on older equipment do not have the capacity or other characteristics of the modern traction motors used on diesel-electric locomotives.

The fourth section of the report, presented by Committee Chairman C. A. Wilson (A. T. & S. F.), gives a general description of wheel slip and wheel-slide devices and outlines the functions they should perform as follows:

A detector system should be available for all types of electric drive locomotives existing and new which will give positive indication and protection against:

(1) Wheel slip during acceleration and high speed.

(2) Wheel slide protection during air and dynamic braking.

(3) Locked wheel protection.

Due to the different types of diesel-electric locomotives in service today, this positive protection can be accomplished by the application of axle mounted equipment and this can be made standard on all types of locomotives used in all classes of service.

Most wheel slip and wheel slide protection devices now on test consist of the following:

1. Axle mounted equipment.
2. Relay Panel.
3. Alarm System.

The axle mounted equipment may consist of (1) Axle mounted commutator and brush system, (2) Individual axle generator, (3) Axle mounted centrifugal switches mounted on each power and idler axle under each unit and to operate on a mile per hour speed differential between each axle regardless of the speed at which the locomotive is being operated. On test a speed differential of 5 m.p.h. was used but this differential should be adjustable to allow for the difference in wheel size under the unit.

The relay panel consists of relays of the proper type that will operate with the axle equipment when the speed differential is reached between any axles under the unit. The relay system is connected to the main generator excitation system so that in case of wheel slip the excitation to the main generator is partially reduced unloading the diesel engine until wheel slippage stops and the engine again resumes full load slowly. The relay panel should also have a timing device with a manual reset, which will operate when wheel slippage continues for a given time, indicating an abnormal condition such as a locked wheel. The timing device must be adjustable so it can be set from 10 to 60 seconds, depending on the service of each particular railroad. This control circuit should be independent of other equipment and function even though the unit is isolated.

The alarm system of this device should operate a light and buzzer in the cab of the locomotive and in addition when the timing relay operates, it should light an alarm light on the relay panel on the unit causing the alarm, making it necessary for the relay to be manually reset and an inspection made of the unit. This alarm circuit should be a separate unfused circuit from the battery.

Such devices can be applied to the present locomotives as well as new locomotives being built and can be connected in such a manner to give any indications or operations that each particular railroad desires.

Test on various types of wheel slip and wheel slide devices are

being followed by the Mechanical Research office of the A.A.R. Central Research Laboratory. Section 5 of the report concerns a request made by a manufacturer to add six incandescent lamps for diesel locomotives to the standard list which now includes only 19 lamps.

Battery-box temperatures and relays to indicate blown battery fuses constitute the sixth section of the report as follows:

The New York Central Railroad has applied a "Klixon" thermostat to three 1000 hp. diesel-electric switching locomotives for tests. The thermostat is mounted above the batteries on a wooden base fastened to the inside of one of the battery boxes and is designed to operate on the air temperature inside the battery box. The thermostat is connected to the voltage regulator and will regulate the battery charging voltage to 75 volts when the air temperature inside the battery box is above 50 deg. F. When the temperature is below 40 deg. F., the battery charging voltage is raised to 77 volts.

This installation was made in May and June 1951 and no conclusive information has been obtained regarding the results or merits of this application.

The Southern Railway System has equipped their passenger booster units with a no charge relay and light for indication of blown battery charging fuse which energizes the alarm circuit on the locomotive and lights a red alarm light mounted on the low voltage cabinet in the unit affected.

The no charge relay is connected across the battery charging fuse in parallel with the fuse and has one normally closed interlock. The interlock is in the circuit to the operating coil of the battery charging contactor and one normally closed interlock is added to the battery charging contactor. The no charge light is connected, through the closed interlock on the battery charging contactor, between the signal negative and to the circuit from the isolation switch to the E. R. Relay.

When the battery charging fuse is blown, the no charge relay will pick up, the interlock on the relay drops out the battery charging contactor, and the interlock on the battery charging contactor is closed, lighting the no charge light and energizing the signal relay and the alarm is received. The alarm and light will stay on until the fuse is replaced or the isolation switch is put in the start position.

Standardization on location and arrangement of receptacles and jumpers on diesel-electric locomotives is the subject of the seventh section of the report. A table and a diagram are included to show a proposed arrangement of jumpers and receptacles.

The eighth and final section is a tabulation of replies received in answer to a questionnaire sent to chief mechanical officers, asking their preference as to the function and location of visual and audible alarms.

Discussion

R. I. Fort (I.C.) asked for a brief description of the 6 new lamps proposed for use on diesel locomotives by one manufacturer. W. S. H. Hamilton (N. Y. C.) replied that some were 75-volt lamps of different capacities and that one is a 220-volt lamp. It has, he said, been the desire of the committee not to exclude lamps which are required, and also not necessarily to increase the number of different lamps. The original number, he said, was 64 which has been reduced to 19.

Concerning the use of a no-charge relay and light for indicating blown battery charging fuses, Mr. Fort asked why it is necessary to add another device to a locomotive, since little trouble has been experienced from this source. "We do," he said, "have a pilot light across the battery charging contact to show if the battery is charging or not."

It was then pointed out that when the battery fuse blows on some types of locomotives, the ammeter will show about 17 amp., indicating that the battery is being charged and that for this reason the relay and light is good. Mr. Fort said that a few years ago, trouble had been experienced by the blowing of battery fuses caused by starting one engine with the other engine running, but that this was now prevented by an automatic disconnecting of charging circuits when the starting button was depressed.

In response to a question from H. C. Paige (N. Y., N. H. & H.) concerning the requirements of controlling battery charging voltage to conform with battery temperature, Mr. Hamilton said that in addition to the thermostat, there is need for only a few feet of wire and a resistor.

Following the discussion of the automotive and electric rolling stock report, a paper entitled, "Diesel Wheel Slippage Investigation by the New York Central," was presented by F. Thomas, assistant to general superintendent equipment, diesel and electrical, New York Central. This paper was published in the October 1951 issue of *Railway Mechanical and Electrical Engineer.*

CONSULTING DEPARTMENT

Cleaning and Testing Of Locomotive Electrical Equipment *

Questions and Answers

Q.—How can carbon be cleaned from traction motors and main generators without dismantling the equipment?

A.—The primary considerations are the design and location of field enclosures, whether or not moisture and other adhesive agents are present in addition to the dust within the field casings, and the skill of maintenance staffs with type of tooling which is provided.

The unanimous opinion is that a dry air blow is the best, where no adhesive agents are present. Metal or hard rubber tube extensions for the air hose allow the air blast to be applied at the critical points. While blowing, an exhaust arrangement should be used to carry away the dust boken loose. This can be obtained simply on most equipment by operating locomotive auxiliary fans.

The too frequent case is that a bonding agent is present to make the dirt stick. There are two schools of thought as to the proper method of dealing with this condition.

One view is that air is still the only satisfactory method. The concern of those holding this view is that direct spraying of a solvent into the machine may force a build-up of deposits in inaccessible locations, making matters worse than when the cleaning was started. If a solvent spray is not used, the technique generally employed is to first blow with dry air, wipe creepage surfaces with a clean rag dampened with solvent, use a fine grade of sandpaper to clean the hard carbon, and reblow.

The other view as to cleaning out carbon and oil is that a solvent must be sprayed into the machine to effectively

* Material presented by the Diesel Electrical Committee at the annual meeting of the Locomotive Maintenance Officers Association held in Chicago, September 17-19, 1951

remove the accumulation and that this practice is all right as long as the material is allowed to dry before any high potential test is applied. On most railroads the use of carbon tetrachloride in pure form is not permitted and where it is used, a mask is provided which affords complete protection to the user. The substitutes which are used are such materials as Stoddard's solvent Nareco solvent, Dearborn 91, or a mixture of 93 per cent mineral spirits and 7 per cent carbon tetrachloride.

For the solvent spray process, a through technique is as follows: Blow the equipment thoroughly, then spray and let the solvent set for 15 to 20 minutes. Scrub with a brush, using brushes to reach the difficult places. After this is done, spray and blow again thoroughly.

Another cleaning method, which is in limited use only. is the blasting with cornmeal. The problem here is how to keep the cornmeal from imbedding in the wrong places, soaking up moisture, and eventually causing grounds.

Q.—What is the easiest method of drying out electrical equipment after it has become wet?

A.—The common method employed for drying out main generators is to blow the generator with dry, warm air in a warm building and then, if possible, place the generator under a small load. If the foregoing fails, the practice is to remove the generator and bake it in an oven.

To dry out traction motors, blow and feed warm air into the traction motor blowers with the blowers running. Throughout the drying process, the resistance of the traction motor to the ground is checked. Also, it is sometimes possible to operate the locomotive at slow speed, combined with a light brake application.

Various devices are available for blowing hot air into the electrical equipment. With each device, a flexible duct or tube can be used to conduct the heat directly to the desired location. One device is a portable heater which burns fuel oil, the exhaust gases being mixed with fresh air and drawn by a fan into the heat conducting tube. The temperature is in the neighborhood of 200 deg. One railroad has conducted experiments which, they say, prove that best results can be obtained by the use of multiple portable, forced convection, electrically-operated space heaters utilizing air discharge temperature in the order of 170 deg., and so designed as to create good control of the hot air blast, together with maximum turbulence within the electrical machine.

Also for the wiring, heat lamps have been used with some success. Drying wire which is inside a conduit is difficult. An expedient which is used in one case is to build a fire inside a nest of steam generator coils, running air through these coils and directly into the conduit.

Q.—How can dirt and moisture be kept out of electrical equipment?

A.—This subject ties in with the general winterization scheme used on a locomotive. The ventilating air intake for the main generator, traction motors, or electrical cabinets must not be directly exposed in any way to outside air because this air will have snow, water or dirt entrained with it under severe operating conditions. The general principle is that all of these air requirements should be supplied from within the engine room. The sides and under surface of the locomotive should be closed up tightly and all of the engine room air requirements supplied up high near the center of the locomotive. In this manner, moisture and dirt which may be entrained with the intake air can be dissipated before it reaches the actual point of air supply to the electrical equipment.

Two winterization schemes are used successfully on northern railroads. One is to obtain all air requirements through a separate hatch opening in the roof after blocking all of the engine room side panel air filters. The other method is to only partially block the engine room side panel filter openings, partially open the engine room false ceilings, and reverse the rotation of one of the engine-cooling fans. In both cases all openings underneath the main generator and high voltage cabinets are blocked off and the underside of the car body sprayed with Insulmat to insure a positive seal.

Two other interesting developments or proposals which are being investigated are the use of dynamic grilles to buff off the dirt and snow at air intakes and the possible use of a heater winding within the electrical machine.

Q.—How long does wiring last and how can its service life best be increased?

A.—Cases are known where railcars built in 1925 and 1926 are still operating with the original wiring. However, present day locomotives with varnished cambric wiring will not last more than six to ten years. The traction motor leads may last only three years. It is expected that the Neoprene or Anhydroprene wiring now being tried will last longer because of its resistance to oil and moisture, but the real answer is to keep the wires out of the oil and moisture and perform periodic cleaning and painting. Keeping oil and moisture away from the wires is nearly impossible with some designs. It is the unanimous opinion that a great deal could be accomplished by side or top connecting main generators.

Q.—What practical measure can be taken to eliminate junction boxes, conduit bushings, and water pockets under the floor?

A.—Where necessary to run conduit under the floor, it should be the longest practical length, eliminating as many fittings as possible. The terminations of the conduit should be periodically inspected and carefully sealed to prevent water or oil getting into the conduit from the ends. Wiring pits should have a medium size drain hole with a pipe extension leading down and terminating at a point about six in. above the rail. Thus, if water should collect in the pit, it will drain off and the danger of snow or dirt entering from the underneath is minimized by the length of the pipe. Such drains must, of course, be periodically inspected to be sure that they are open. On one type of passenger locomotive, an improvement can be effected by eliminating the steam trainline expansion joint which is under the floor and near the main generator pit. When this joint leaks, vapor comes up through the engine room deck and gets into the wiring of the main generator. With the joint eliminated, the expansion is taken care of by using two swivel type joints in the steam trainline at the rear end of the locomotive, as it leaves the steam separator at the steam generator to enter the main steam trainline.

Q.—Should a traction motor receive a light cleanup and the bearing run at the time of wheel change, regardless of whether or not the motor has reached its overhaul mileage?

A.—It is generally agreed that this is a good practice to follow, particularly because it gives a good opportunity to check on the bearing condition. The secondary reason for so doing, is that the brush rigging and creepage surfaces are more accessible and can be better cleaned than when the traction motor is underneath the locomotive. On one railroad it is also believed desirable to check the commutator at this time with a dial indicator for a maximum of .002 run-out.

Q.—What is the most satisfactory method of applying voltage and current tests to a traction motor, both prior to and after overhaul?

A.—The primary instruments are the megohm meter and the high potential tester. An excellent type of high potential machine uses a transformer with primary control, two rectifier tubes, a 2,000-volt, 1-mf. condenser and a d.c. voltmeter connected across the test leads. With this type of machine, it is possible to tell the exact voltage at which the insulation is breaking down without damage to the equipment under test. Up to 1,200 volts can be applied prior to the overhaul. If loose joints or high resistance connections are suspected, a low reading ohm meter can be used during the preliminary testing. After overhauling, a high potential test of 2,000 volts should be applied and, in addition, a high frequency test made where the equipment is available. Then a one-hour bearing run should be made, using a motor generator set type of testing machine which will apply 450 amp. to the field circuit and 1,000 volts to the armature circuit. With the traction motor running, the motor may be checked again for grounds by connecting a voltmeter from the various motor leads to ground.

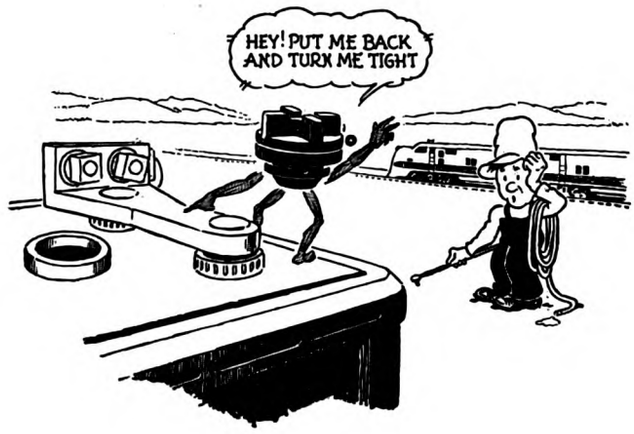
Diesel-Electric Locomotive Batteries

Questions and Answers

Q.—What care should be given to battery vent plugs?

A.—Keep the vent plugs securely in place at all times, except when taking hydrometer readings or adding water.

All vent plugs are provided with small openings for the escape of gas. Clogged openings may cause sufficient gas pressure within the cell, to break the seal between the jar and the cover. If these openings are found to be clogged with dirt, when examined during any inspection, they should be immersed in water and thoroughly cleaned. It may be necessary to use a piece of wire to clear the openings.



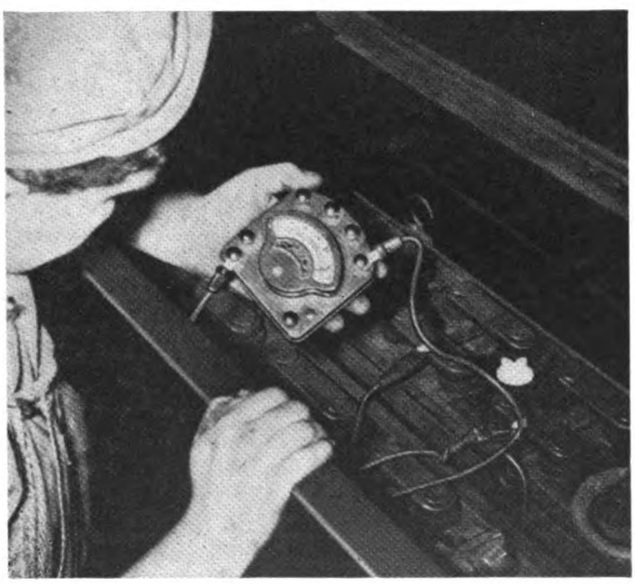
If a battery vent plug could talk, this is what it might say

The Electric Storage Battery Company recommends that accumulated gum or grease deposits on the plugs be removed by cleaning with carbon tetrachloride or Stoddards Cleaning Fluid. Remove cleaning fluid with low pressure air

A cracked vent plug, or one upon which the soft rubber gasket does not seal tightly, or from which the hard rubber disc below the gas chamber has been lost, must not be used.

Vent plugs, when removed, should be placed bottom side up, on the battery covers. When a vent plug is laid right side up, the dirt it picks up may be introduced into the cell, contaminating the electrolyte, which, in turn, may shorten battery life.

Cell covers damp with electrolyte may indicate clogged vent openings. Damp covers also may be caused by poorly applied plugs, addition of too much water or a break in the seal.



White porcelain vent plug in right foreground indicates the next cell to be used in taking a hydrometer reading. Mechanic is checking cell voltage with voltmeter

Q.—Why rotate battery vent plugs?

A.—Each time a hydrometer reading is taken, a small amount of electrolyte may be lost. If one cell is read continuously, its fully charged specific gravity will gradually be lowered, resulting in individual low cells.

To avoid excessive loss from any one cell, The Electric Storage Battery Company recommends that a different cell be used in each half of the battery every time a gravity reading is taken.

By the use of a special plug (white porcelain or painted), the change in cells can easily be marked and followed as is indicated in the photograph. Start with the positive terminal cell in each half of the battery, and follow the series circuits until the negative terminal cell is reached. The special plugs should then be returned to the positive terminal cells, and the same routine repeated.

Therefore, after each hydrometer reading change the white porcelain vent plug to the next cell, thus moving progressively through the battery circuit so that all cells will be read and recorded about every four months.

S. K. LESSEY
The Electric Storage Battery Company

EDITORIALS

Santa Fe Diesels Quickly Reconditioned

Numerous railroads and private car companies experienced severe damage to equipment during the record-breaking Kansas floods last July and are to be commended for their success in restoring service as quickly as they did. One of the most spectacular performances was that of the Atchison, Topeka & Santa Fe which had about 5,500 freight cars, 21 steam locomotives and 51 diesel units involved in the flood and, by organized, intensive effort on a three-shift basis, put most of this equipment back in service in a month. As a matter of fact, the 51 diesel units were reconditioned at Santa Fe system shops in 17 working days.

With water up to 22 ft. deep in the Argentine enginehouse, 26 ft. on the car repair tracks and some of the equipment fully submerged for six days, the magnitude of the job can hardly be overestimated. About 650 cars had to be rerailed and in many instances car bodies reassembled on trucks from which they had floated away. By working full crews of men around the clock, car forces repacked journal boxes on 350 cars a day. AB brake valves were replaced with serviceable equipment or removed and cleaned thoroughly on all cars regardless of ownership, foreign lines not being billed for this cleaning operation.

Experience in reconditioning 16 road diesel units and two general-purpose diesels at the San Bernardino, Cal., shops was typical. Before moving the locomotive units, suspension and axle-journal bearings had to be cleaned out and repacked, armature bearings lubricated, gear-cases cleared of mud and silt and new crater compound applied. On arrival at San Bernardino, mud and silt still filled the cabs and engine rooms to a depth of six to eight inches and all of the electrical cabinets were caked with mud, conduits and junction boxes below the floors being completely packed with fine silt which hardened like flint when dry.

The damage by corrosion to electrical equipment was severe, especially wiring, contactors, voltage regulators, flexible shunts, terminals, and load regulators. In some instances, all of the equipment in the high- and low-voltage panels was damaged to such an extent that it was beyond repairs. One unusual fact noted was that the corrosion of electrical parts continued after being cleaned with high-pressure hot water, and that this action was retarded by spraying all parts with kerosene.

Other observations of interest were that varnished cambric insulated wire, with cotton binding, did not stand the exposure and immersion in water, but coils and wires coated with Sterling or Glyptol paint experienced little damage. Okonite Okoprene wire was reported as showing great resistance both to oil and water damage.

All types of heating facilities were used with varying degrees of success to dry out equipment after washing, and these facilities included a large dry kiln, heat-treating furnace, steam heaters, infra-red lamps and internal electric heating of armatures. A Scheu Hot Shot heater worked well in drying out diesel engine and electrical parts, including water-soaked conduit, with a flow of hot, dry air under low pressure. As a matter of fact, individual machines of this type delivered up to 1,600 cu. ft. of air per min. at 250 to 300 deg. F., equivalent to the release of 300,000 B.t.u. per hr. with a fuel rate of 2¼ gal. of fuel oil or kerosene per hr.

Diesel locomotive builders cooperated by supplying materials to the fullest extent possible in the rehabilitation program and the balance of parts reconditioning and assembly work at San Bernardino shops was handled on a production basis by specialized groups well supplied with all necessary tools and equipment. Flood-damaged diesels, as well as 10 wrecked units were repaired at San Bernardino in addition to current operating requirements and, during August, a total of 85 diesel locomotive units was released at this shop. The electric shop output included 195 traction motors (40 armatures rewound) and 21 main generators (7 armatures rewound). Also during the month, 20 diesel engines were completely dismanteled and rebuilt.

While no considerable percentage of diesel motive power on American railroads will ever be subjected to flood conditions such as occurred in Kansas last July, experience on the Santa Fe and other roads indicates the desirability of making diesel locomotive parts, especially electrical equipment, as highly resistant as practicable to oil and water damage. Alert manufacturers are already working on this end.

An Example of How Good Maintenance Pays Off

One of the papers presented before the last meeting of the Air Brake Association, and which is abstracted elsewhere in this issue, outlined three positive benefits that accrue from intensive maintenance. While the good maintenance and the benefits referred to apply specifically to certain phases of air-brake work, there is little reason to believe that equivalent gains would not result from equivalent standards of maintenance on other railroad equipment.

Three positive benefits from the high standard of maintenance are given. One, the brake operation is decidedly improved, reducing overbraking and overuse of the brake, and giving such contingent benefits as considerable savings in fuel and air. Second, on high-speed

streamliner service traversing both level and mountainous terrain, brake shoes are constantly averaging 25,000 to 30,000 miles of life. Third, there is a substantial reduction in brake-rigging wear—so little that after some 650,000 miles of service, no serious wear occurred, and the indications are that parts will not require renewal until nearly a million miles of usage.

The committee that prepared this report stated at one point: "It appears to us, therefore, that there can be no doubt, it is far less expensive in the long run to do a complete, careful and thorough job of preventive maintenance and have the benefit of improved service, long life and reduced repair costs, than it is to do a minimum job and have the disadvantage of poorer service, shorter life and higher repair costs."

Who doubts that this conclusion is equally applicable to car and locomotive maintenance other than parts of the air brake system?

Catch Them Before They Get Sick

Railway passenger traffic is being increasingly encroached upon by airways and highway competition. This is not made evident by looking at passenger traffic alone, but it becomes significant when the traffic volume figures of the different kinds of transportation are compared.

The situation raises the question: What is passenger traffic worth to the railroads and what should be done about retaining what they have or increasing their percentage? The defeatist says: "It will only be a matter of time before all passenger traffic goes to the airways and the highways—it doesn't provide us with any net income anyway."

But nearly everyone agrees on two things. These are that passenger service has an important bearing on public relations with the railroads, and that reduced cost of transportation has a salutary effect on volume. For nearly all of the long-haul service, the railroads have gone in for de luxe service and few have made any sincere attempt to increase volume by reducing costs.

So the passenger pays a good price for fine service. He expects to get what he pays for and objects to anything short of the best. An air conditioning failure in hot weather may cause him considerable discomfort, and when the railroad deliberately puts him into a car which has been out in the yard in the sun for hours and in which the air conditioning has failed he is the victim of fraud. The railroad charged him for something he didn't get.

That is why, at the recent meeting of the Electrical Sections, it was said that a car with failed equipment should be held out of service—that an air conditioning failure was just as important as a locomotive failure. To the passenger, it may be more important. In one case, he loses a little time, and in the other, he suffers discomfort.

At the same meeting referred to, it was the consensus of opinion that most failures are caused by inadequate maintenance, and that this, in turn results from too few adequately trained maintainers. It becomes necessary to let equipment go extra trips with the hope that it will come back in operative condition.

Correction of the situation requires more attention to preventive maintenance, but this does not necessarily mean higher maintenance costs. It is much cheaper to keep well than to be doctored after you are sick. It is also a lot more pleasant both for you and your family.

NEW BOOKS

SIMPLIFIED MECHANICS AND STRENGTH OF MATERIALS *By Harry Parker, professor of architectural construction, University of Pennsylvania. Published by John Wiley & Sons, 440 Fourth avenue, New York 16. 275 pages. Price, $4.*

Following the pattern of other books in the "Simplified" series, the sixth volume contains an elementary treatment of the subject for use by practical men interested in mechanics and construction. The author, using simple arithmetic and algebra, concentrates on material bodies in which there is no motion. After a general survey of all the mechanical forces to be considered, he discusses their specific applications to columns, rivets and welds, shafts pipes and tanks, concrete and retaining walls and dams. A wide variety of illustrative problems is included, also tables of allowable stresses, properties of sections, and other useful engineering data.

INSPECTION AND GAGING. *By Clifford W. Kennedy. 512 pages, 6 by 9 inches; 319 illustrations. Published by The Industrial Press, 140-148 Lafayette St., New York 13. Price $7.50, plus 62 cents for shipping to Canada or overseas.*

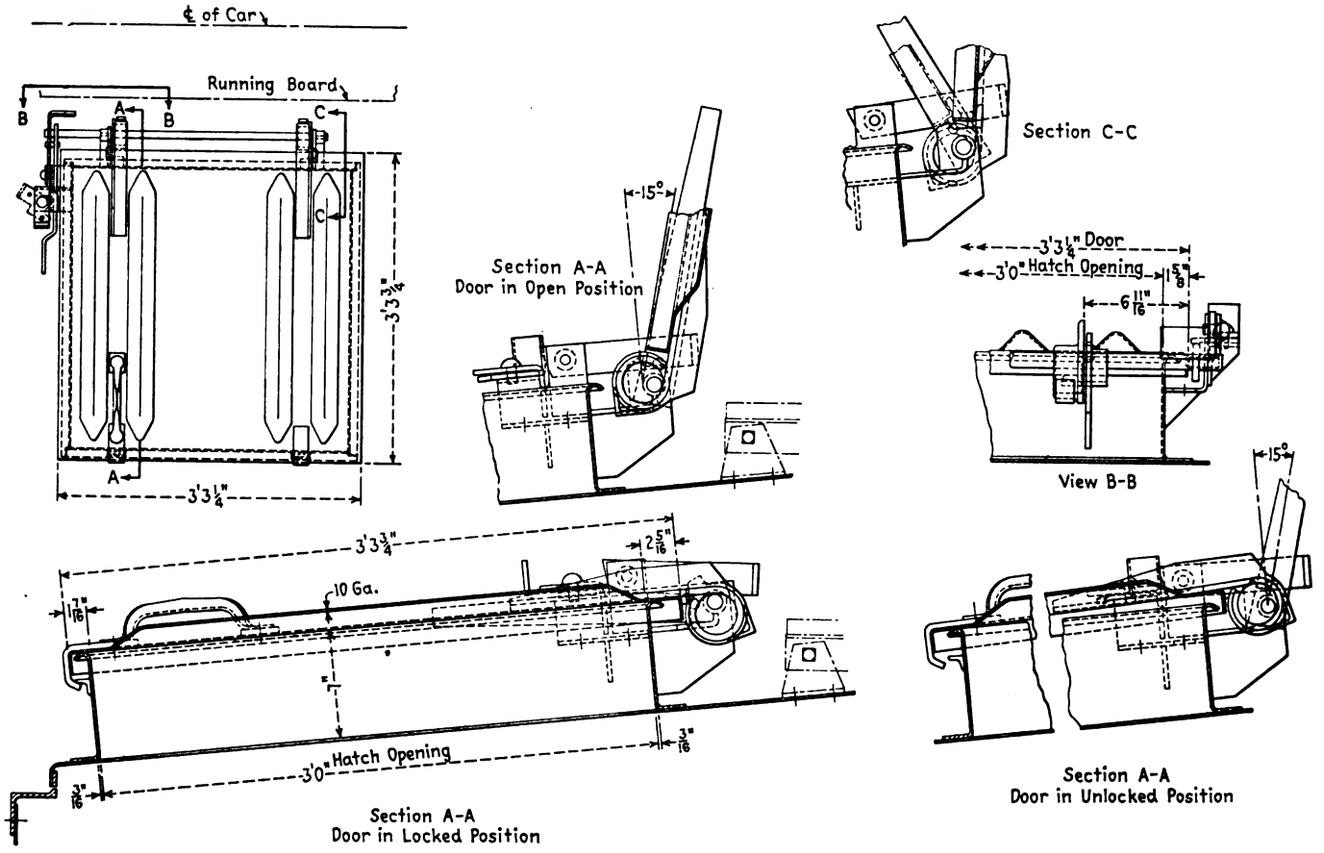
This book has been written primarily to meet the need for a text and reference work that can be used in the training of inspection personnel.

The author deals with the many phases of inspection work and their application to present-day manufacturing operations. He describes in detail a wide variety of manual and automatic measuring tools, devices and gages, and shows how they can be used accurately and efficiently. Not only are the best procedures for securing accurate results given, but possible errors to be avoided are clearly described. Inspection problems are analyzed, and the steps in solving them illustrated.

The seventeen chapters in the book deal with the following subjects: The Need and Function of Inspection; How Specifications Aid the Inspector; Tolerances and Allowances; How Standards Aid the Inspector; Basic Principles and Techniques of Measurement; Fixed Gages; Surface-Plate Methods and Equipment; Mechanical Indicating Equipment; Electrical and Air Indicating Equipment; Optical Measuring and Inspection Equipment; Gaging and Inspection of Screw Threads; Special Measuring and Inspection Problems; Gage Checking and Calibration; 100 Per Cent Inspections; Quality Control and Sampling; Process Inspections; and Hints on Making a Good Job Better.

Half-tones and line drawings form a useful reference for those who wish to become acquainted with the wide variety of gaging equipment and measuring tools and devices now available.

NEW DEVICES



Latitudinally operated hatch cover and frame for covered hopper cars

Automatic Locking Hatch Cover

The outstanding characteristic of the eccentric actuated and automatic locking hatch cover for covered hopper cars is its safety of operation. Developed by the Youngstown Steel Door Co., Cleveland, its unique design positions the shaft and operating lever of each mechanism near the running board of the car roof.

Operation of the levers and the opening and closing of hatch covers compels the men to stand in proximity to the middle of the roof. In the event of accident, these men will be protected.

The hatch frames to which the covers are hinged are of conventional construction and carrry the entire operating mechanism. On single units, embodying one cover, one frame, and one locking mechanism each, the unit is ready for service as soon as the frame is secured on the roof. The cover is formed with a pair of corrugations extending parallel and adjacent to each side thereof. Hinges formed of rolled angle members are secured to the portion of the covers adjacent to the running boards. The hinge pins are cams eccentrically mounted on a shaft which rotates in butts carried by the hatch frame. The shaft is actuated by a lever. When the cover is closed, the lever is locked by a latch, also carried by the hatch frame, and can be sealed. Locking members on the side of the cover opposite the hinges extend between the corrugations so that these serve to stiffen the covers and provide a tie between the hinges and the hook-shaped locking members. These lock by engaging angles on the hatch frame as the cover is seated. This is brought about by closing the cover, the hook-shaped members clearing the angles on the hatch frame because of the position of the eccentric hinge pin. Swinging the lever toward the roof after the covers have been lowered produces rotation of the shaft and eccentric hinge pin. This causes the cover to move on the frames toward the running board which engages the locking member over the angle and also lowers the hinge end of the cover upon the frame. The sealing contact between the cover and the hatch frame makes the device a favorite of shippers of molding sand and cement.

To open the covers the lever is moved upward toward the running board and is automatically locked by a swinging latch. This moves the cover away from the running board and releases the lock so that cover can be lifted to open position.

It is impossible to damage the covers or locking mechanism by improper operation. The lever cannot be swung through such an angle that it can be made to lie upon, or foul, the running board. Lowering the lever to the roof before the cover has been closed is also prevented by an interlocking engagement with the cover which also prevents the latter from being closed until the lever is returned to its fully open position.

The drawing illustrating the device shows a single latitudinally operated cover. The hatches can be arranged so that they open longitudinally parallel to the running board. In this case the operating lever is alongside the running board. Two latitudinally operated covers can also be arranged for dual operation. This involves connecting the two 1-in. shafts with a 1-in. pipe coupling and operating both with the lever device on one of the covers.

(Turn to page 104)

HOW UNIT EXCHANGE SAVES YOU TIME AND MONEY

WHEN you order a Unit Exchange assembly from Electro-Motive, you receive from our pool a completely rebuilt, fully guaranteed unit—shipped F.O.B. our nearest Factory Branch.

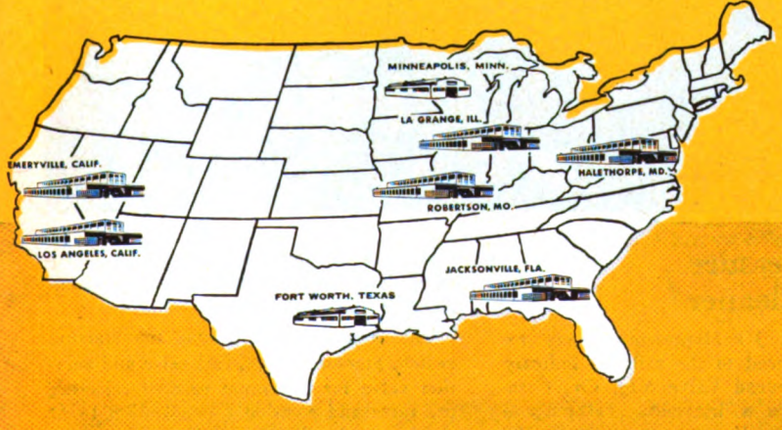
There is no waiting for your own unit to be rebuilt—no need for large inventories. We carry the spares for you—and there's no extra charge for this service.

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And don't forget *every* assembly rebuilt by Electro-Motive (whether Unit Exchange or Rebuild-and-Return) carries the same guarantee as new—*100,000 miles or one year of service*, dating from time of application on the locomotive, *not* the date of shipment.

Let us show you how much Unit Exchange can save your railroad. Consult your Electro-Motive representative, or contact nearest Factory Branch or Parts Warehouse listed below.



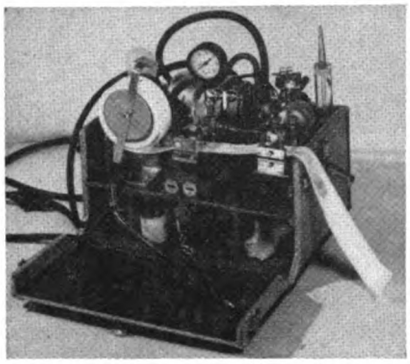
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Continuous Gas Filtering Recorder

This is a multi-purpose instrument for laboratory maintenance processing that is applicable as a recorder of transient phenomena; monitor for equilibrium condition; pick-up for warning systems; operator of control devices and a detector and locator of leaks.

The medium under test is sampled at a uniform rate through a continuously progressing filter tape, guided past a recording head. Adjustment of sampling rate and selection of both tape speed and working area in the head give a wide range of sensitivity and facilitate calibration.

The unit can be utilized for recording gases in three basic groups: (A) combustion—exhaust and smoke of gasoline, diesel, turbine engines, oil burners and furnaces; (B) air pollution—dusts and aerosols in industrial plants, mills and blast furnace gas and (C) mixed gases such as carbon, sulfur, compounds or fumes.

In group A, tests are evaluated by a visible deposit of carbon particles. In group B, colorless dusts are made visible by chemical action and in group C, except in the case of certain fumes, tests are made with the tape activated by suitable reagents to produce a visible record.

The device, made by E. K. Von Brand, Dobbs Ferry, N. Y., utilizes a 110 volt, 60 cycle power supply and is equipped with independent switches for vacuum pump and tape movement that permit spot testing with internal timers.

◆

Lens Tissue and Dispenser

Designed for use in keeping safety goggles clear, a new large size silicone treated lens tissue and metal dispenser has been made available by the American Optical Co., Safety Products Division, Southbridge, Mass.

These tissues, treated with a coating of silicone, quickly remove from lenses foreign matter such as dust, dirt and finger marks. Tissues, by depositing the silicone on the lenses, make each wiping last longer and the next cleaning easier and faster.

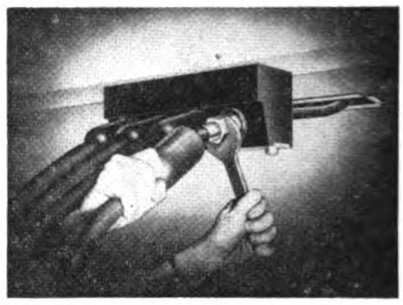
The dispenser is of 20 gage steel construction and is furnished with four mounting screws and a lock to prevent pilfering. This unit allows the removal of only one 5 by 6¾ in. sheet at a time.

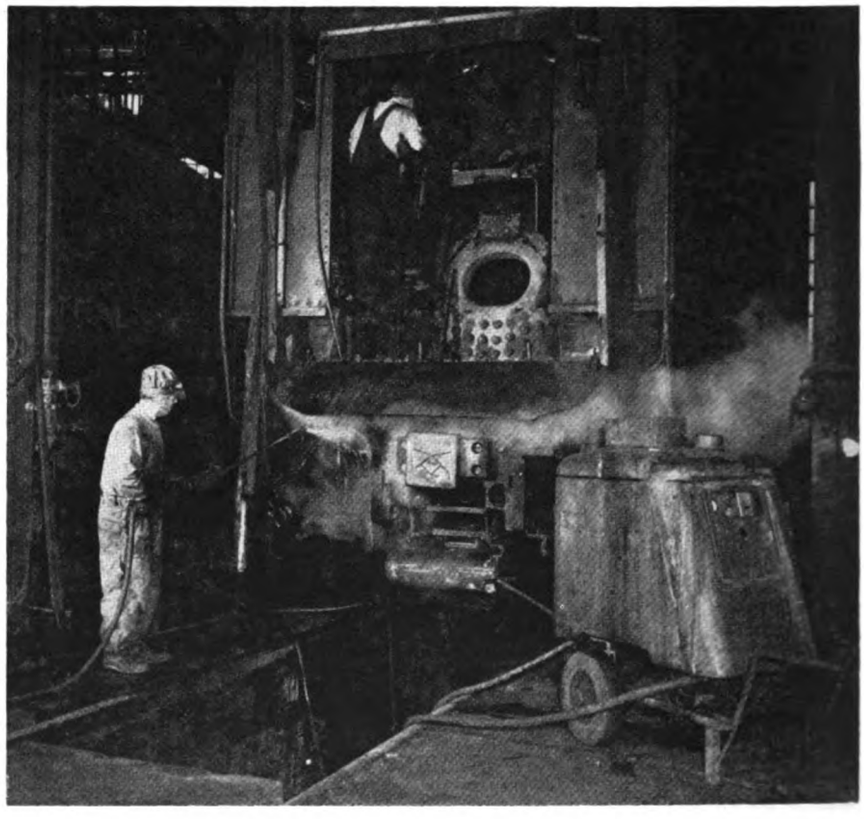
◆

Terminal Block for Traction Motor Leads

A device for reducing the time required for change-out of traction motors on diesel units is now being offered by the Paxton-Mitchell Company, Omaha, Neb. It consists of a terminal block fitted with Williams grip connectors, and the manufacturer claims that taping and untaping cables and the maintenance of glad hands at every change-out is no longer necessary. Only a ¼ turn of the buttress thread nuts is required to tighten cable connections.

The terminal block is made of neoprene to assure proper insulation of terminal connections in all kinds of weather. The terminal connections are made of a special alloy copper to assure the highest conductivity of electrical current. The connectors are so designed to assure equal contact pressure over the entire mating surface of each connector and also provides for a tensile pull of 1,500 lb. Connectors which become damaged may be renewed without replacing the complete block. Tests and service applications have shown that the connectors will perform satisfactorily in snow and ice and under other adverse weather conditions.





High Pressure Steam Cleaner

The model JO Hypressure Jenny recently introduced to the railroad industry by the Homestead Valve Mfg. Co., Coraopolis, Pa., is a heavy-duty, all-purpose steam cleaner. It operates at 80 to 120 lb. pressure, and has a 90 gal. per hr. capacity.

Featuring the convenient no-stoop control panel and its high capacity of boiling hot cleaning spray, the unit combines simplicity of design and construction with convenience of operation.

The control panel groups the starting switch, pressure gauge, fuel valve and solution valve for maximum ease of selecting pressures and solution concentration to fit the job on hand. This device operates on the continuous flow principle, not nozzle controlled. It starts automatically when drop cord is plugged into an ordinary electric outlet and stops when plug is removed.

ONLY TIREX HAS THE SELENIUM NEOPRENE ARMOR

Only Simplex-TIREX cords and cables are jacketed with the famous Selenium Neoprene Armor. This famous cured-in-lead jacket is well known wherever tough, hard jobs are found. Whether it is coal mining, ship building, open pit mining operations, rock quarrying or foundry work the tough, cured-in-lead jacket provides the kind of staying power that you want. Wherever rough, abrasive conditions are found, there you will find the jobs that TIREX excels at doing.

Actual service records show that Simplex-TIREX cords and cables have proved to be the most economical because the Selenium Neoprene Armor lasts so long.

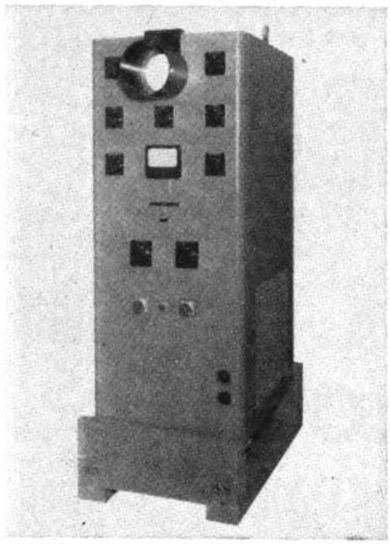
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D. C. Armature Insulation Tester

A winding-insulation tester for d.c. armatures, series field coils, and low-impedance a.c. stator coils, has been announced by the Special Products Division of the General Electric Company. The device will detect and aid in locating faults in turn-to-turn, coil-to-coil, and winding-to-ground insulation in d.c. armatures of any size and rating. It is designed for testing large motors and generators such as those in railroad service.

The tester consists of a repeating type, surge-voltage generator which operates 60 times a second and a cathode-ray oscilloscope, all in one cabinet. A fixture is provided for applying test voltage to the commutator of the armature being tested.

According to G.E. engineers, the new tester can check an entire armature in as little as three or four minutes. As each coil is being inspected, the operator has merely to glance at the oscilloscope screen to see if the surge wave shown is of proper shape and amplitude. Any variance from the correct wave indicates a fault in the tested armature.

The heart of the new device, the surge generator, consists of a 0.5 mf. capacitor which is charged in one-half cycle and discharged in the next half cycle. Voltage on this capacitor is adjustable in two per cent steps up to a 7,500-volt peak by means of two tap switches and an autotransformer. The discharge takes place through a pair of ignitron rectifiers connected back to back. This system permits oscillatory output and complete discharge of the surge capacitor. Coaxial cables conduct the surge to the commutator contact fixture.

Once triggered by the surge, a standing wave is shown on the oscilloscope screen. Sensitivity is variable by voltage divider so that the surge-wave picture may be adjusted to convenient proportions for the full range of surge voltages. Insulation faults are indicated by a change in wave shapes or amplitude or both.

The tester is 20 in. wide, 30 in. deep, 48 in. high, and weighs approximately 800 lb. It operates on a power supply of 230 volts, 60 cycles, and is three-wire, single-phase fused for 30 amp.

◆

Ultrasonic Testing Service

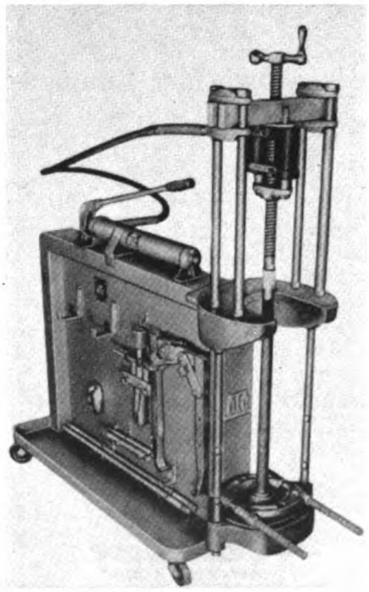
Testing with the Reflectoscope and Reflectogage is now being offered by Sperry Products, Inc., Danbury, Conn., to industrial concerns which have occasional need for ultrasonic non-destructive testing, but whose needs do not warrant purchasing an instrument or training an operator.

This field service provides day-to-day testing at the customer's plant or designated location by an engineer with Sperry's apparatus. The customer is furnished with a report of condition of material at the conclusion of the test.

The Reflectoscope locates discontinuities in metals and plastics by directing pulsed ultrasonic beams through the material and measuring elapsed time of reflections from the discontinuities in the path of the beam. This unit can be used for checking stock before machining, for quality control, maintenance inspection of parts subject to fatigue cracks, etc.

The Reflectogage measures thickness of metals and other materials up to 4-in., from one side only.

◆



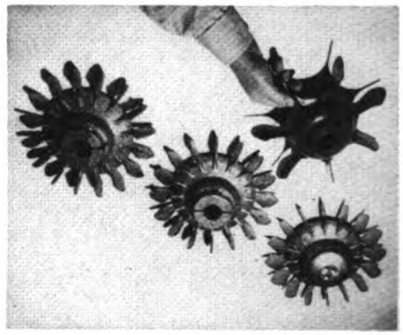
Hydraulic Tool Puller

Recently announced is the Portable Hydra-Tote, a unit that takes pulling tools to the job in place of hauling the job to the tools. Made by the Owatonna Tool Co., Owatonna, Wis., it holds the complete OTC hydraulic pulling system. With the OTC hydraulic Power-Twin Ram and Pump combination, the device is ideal for maintenance work and is easily moved to any spot in the shop. In addition, it provides a 17½ ton hydraulic press.

This unit provides a place for a complete OTC puller set. Permanent steel hangers for basic items and a tray for extra parts to reduce the danger of losing or misplacing tools.

Of sturdy, welded steel construction, it is 32 in. high, 36½ in. long, 16 in. wide at the base and 4 in. wide at the top. There is 10½ in. clearance between the press uprights, 11 in. clearance from the ram to the top of the press plate and 34 in. from top of press plate to the floor. Vertical adjustment is possible with interchangeable legs in the upper press frame and three easy adjustments in the lower press frame. It is equipped with 3 in. rubber casters for easy mobility.

◆



Plastic Motor Ventilating Fans

Plastics are now being used by the Westinghouse Electric Corporation to replace critical aluminum and bronze for blowers in small, totally-enclosed, fan-cooled a.c. motors. The plastic blowers consist of a polyester resin, reinforced with glass fibers. Glass fiber reinforcement has been found to be superior to organic fiber reinforcement because of increased resistance to chemical attack, and increased strength per pound.

The plastic blower has many advantages over the aluminum and bronze blowers it replaces. It is unaffected by the chemical agents that attack the metals. Hence, it is desirable on motors used in refineries, chemical plants, and process industries where corrosive atmospheres may be present.

The plastic blower is as much as one-third lighter in weight than its metal counterparts. While this may be but a matter of a few ounces, the reduction of inertia where frequent, rapid reversals are required is worthwhile. Preliminary tests indicate that the plastic blower has better resistance to abrasion than its predecessors.

These advantages are obtained without sacrifice in blower performance. The blower has successfully passed overspeed tests at four times normal speed. Westinghouse currently is applying these new plastic blowers to totally-enclosed, fan-

(*Continued on page 136*)

RUGGED DEPENDABILITY FOR TOUGHEST DUTY ON ANY 'ROAD

QUAKER HOSE

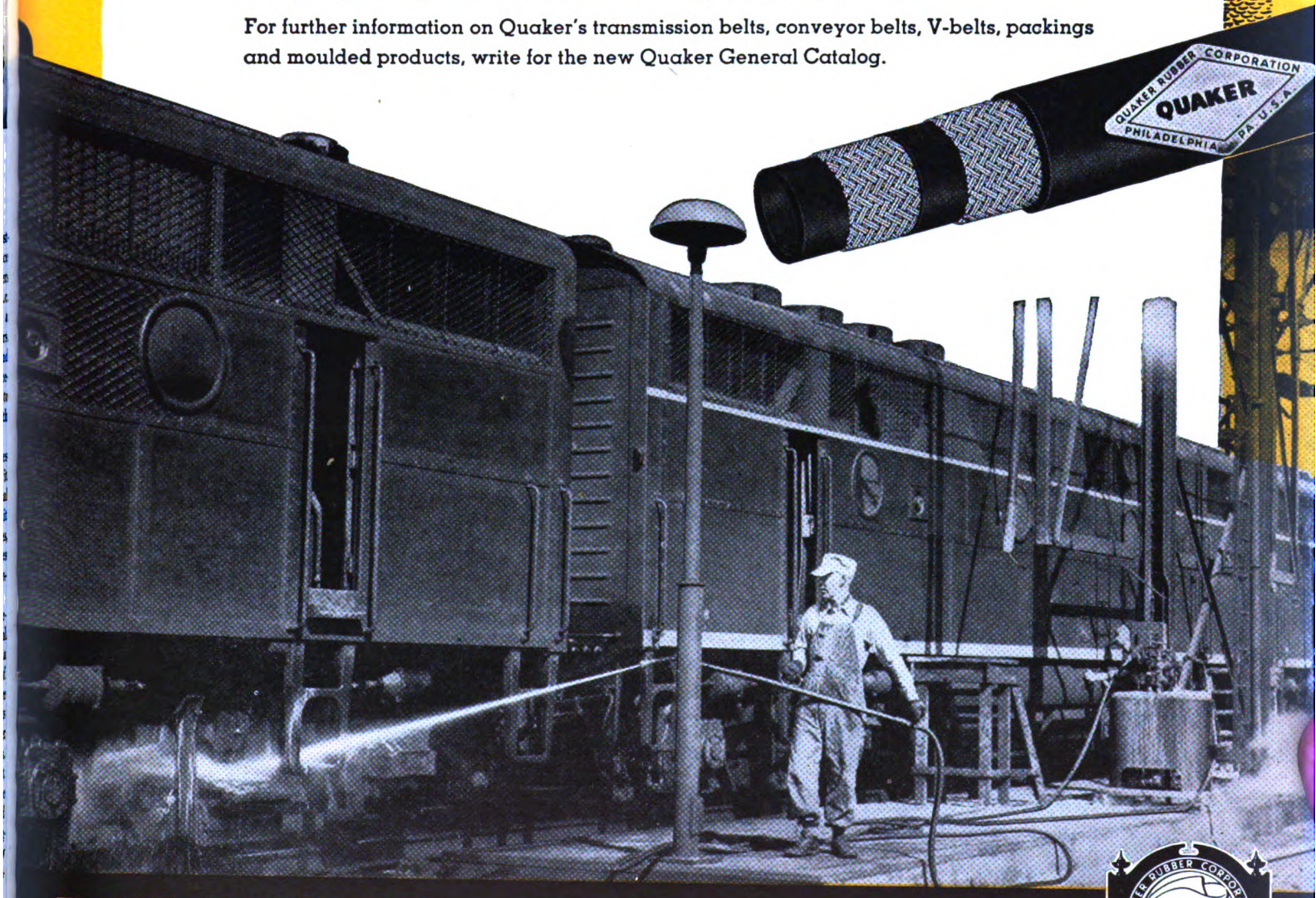
FOR AIR... WATER... STEAM... CHEMICALS

Quaker Hose takes the worst and gives the best in the toughest types of railroad service. It withstands heat, weather, abrasion and strain.

That's why leading railroads throughout the nation specify Quaker Hose where the going is tough and the duty severe. Quaker Hose is made with the finest cotton yarn, scientifically constructed in strong, resilient rubber. Result . . . extreme flexibility, with outstanding resistance to crushing and wear.

There's a Quaker Rubber Hose for every requirement of the railway industry. In the "yard," or on rolling stock, whenever you need hose or any rubber product with proved ability to give longer service with less maintenance, specify Quaker.

For further information on Quaker's transmission belts, conveyor belts, V-belts, packings and moulded products, write for the new Quaker General Catalog.



QUAKER RUBBER CORPORATION

DIVISION OF H. K. PORTER COMPANY, INC.

PHILADELPHIA 24, PENNA. BRANCHES IN PRINCIPAL CITIES

QUAKER RUBBER CORPORATION PHILADELPHIA, PA. QUALITY SINCE 1885

REG. U. S. PAT. OFF.

NEWS

D.P.A. Announces C.M.P. Allotments For 1st Quarter

THE railroad program has been allotted 1,640,750 tons of steel, 86,360,000 lb. of copper and copper base alloys, and 6,000,000 lb. of aluminum under the Controlled Materials Plan for the first quarter of 1952, according to Manly Fleischmann, administrator of the Defense Production Administration.

A statement issued later by N.P.A. said that the allotments would permit production in the first quarter of the following 18,000 domestic freight cars; 2,000 domestic tank cars; 250 domestic industrial cars; 1,200 freight cars for export; 636 domestic locomotives; 60 locomotives for export; 50 industrial locomotives; 54 Army locomotives; and 332,000 tons of rail for maintenance, repair and operating supplies.

The statement said this program had been outlined by N.P.A. officials at an October 16 meeting with the advisory committees representing the railroads and the contract car builders. The first-quarter allotments represent a reduction from those of the current quarter which contemplate production of 27,000 cars, including 2,500 tank cars.

"It was reported that orders for about 150,000 tons of materials allotted to the railroad industry could not be placed on mill schedules during the fourth quarter. N.P.A. said its Railroad Equipment Division has appointed an expediter to help manufacturers place authorized controlled materials orders.

Dieselization of Railroads Has Reached Half-Way Point

A QUIET industrial revolution, begun in 1924, has made such progress that dieselization of American railroads has reached the half-way point, the Society of Automotive Engineers National Diesel Engine meeting at Chicago, October 29-30, was informed by E. K. Bloss, mechanical superintendent, Boston & Maine, Boston. Mr. Bloss reported that about 14,000 diesel locomotives producing a total of 17,500,000 installed horsepower now are operating on American railroads, producing more than 40 per cent of total train-miles and 60 per cent of yard switching. He said the revolutionary trend started in 1924, when two locomotives were placed in switching service to eliminate the smoke nuisance in large-city railroad yards.

The S.A.E. held three national meetings at Chicago simultaneously, the Diesel Engine and the Fuels and Lubricants meetings convening in the Drake, and the Transportation meeting in the Hotel Knickerbocker. Engineers attending the three meetings assembled at the Drake for a joint dinner October 30, addressed by C. F. Kettering, director, General Motors Corporation on the subject "Future Energy Supply."

Railroaders demand much of diesel-electric locomotives, Mr. Bloss explained, including tremendous power output, fuel capacities for a week's operation without replenishing, satisfactory functioning regardless of altitude, heat, or cold and ability to operate continuously with minimum simple repairs or adjustments. He said the locomotives are expected to serve long, fast runs in level areas at high sustained speeds, climb mountain grades with peak power production for prolonged periods, and then suddenly change to switching service with its prolonged periods of idleness and sudden, brief demands for full power.

(*Continued on page 112*)

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of July 1951	Month of July 1950	7 months ended with July 1951	7 months ended with July 1950
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	22,471	28,800	180,267	194,149
3-06	Total, Diesel-electric	22,627	17,660	151,227	115,356
3-07	Total, electric	767	803	5,729	5,646
3-04	Total, locomotive-miles	45,866	47,271	337,244	315,182
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,610	1,640	11,955	10,680
4-06	Empty, total	851	855	6,020	5,758
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	38,785	47,800	310,617	316,052
6-02	Total in oil-burning steam locomotive trains	11,444	14,071	84,724	84,317
6-03	Total in Diesel-electric locomotive trains	62,103	50,076	421,940	325,182
6-04	Total in electric locomotive trains	2,024	2,150	15,650	14,829
6-06	Total in all trains	114,361	114,127	833,033	740,522
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.04	1.05
10-02	Loaded freight car-miles	38.90	38.90	39.40	37.90
10-03	Empty freight car-miles	20.50	20.20	19.80	20.40
10-04	Total freight car-miles (excluding caboose)	59.40	59.10	59.20	58.30
10-05	Gross ton-miles (excluding locomotive and tender)	2,762	2,704	2,744	2,625
10-06	Net ton-miles	1,287	1,232	1,283	1,183
12	Net ton-miles per loaded car-mile (M-211)	33.10	31.70	32.60	31.30
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	65.40	65.70	66.50	65.00
14	Averages per train hour (M-211):				
14-01	Train miles	17.10	17.10	17.90	17.00
14-02	Gross ton-miles (excluding locomotive and tender)	46,520	45,681	45,891	44,084
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	42.90	45.20	45.70	43.60
14-02	All	40.80	42.30	43.50	40.60
15	Average net ton-miles per freight car-day (M-240)	884	882	944	824
17	Per cent of home cars of total freight cars on the line (M-240)	39.30	38.00	37.00	44.30
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	9,855	12,377	73,981	80,613
3-06	Diesel-electric	16,828	15,164	111,663	99,486
3-07	Electric	1,640	1,640	11,336	11,157
3-04	Total	28,322	29,181	196,980	191,257
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	278,312	281,257	1,908,684	1,833,835
4-09	Total in coal-burning steam locomotive trains	50,053	64,680	386,910	411,667
4-10	Total in oil-burning steam locomotive trains	35,016	39,434	234,631	249,759
4-11	Total in Diesel-electric locomotive trains	176,141	160,092	1,166,750	1,052,463
12	Total car-miles per train-miles	9.68	9.52	9.54	9.37
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,061	1,357	8,748	9,699
1-02	Steam, oil-burning	218	259	1,677	1,623
1-03	Diesel-electric[1]	2,926	2,525	20,272	16,657
1-06	Total	4,228	4,166	30,878	28,160
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	41	56	343	421
2-02	Steam, oil-burning	13	13	91	90
2-03	Diesel-electric[1]	248	234	1,683	1,565
2-06	Total	335	339	2,351	2,312
3	Hours per yard locomotive-day:				
3-01	Steam	6.90	7.90	7.90	7.70
3-02	Diesel-electric	16.60	17.10	17.30	17.20
3-05	Serviceable	13.70	13.80	14.40	13.80
3-06	All locomotives (serviceable, unserviceable and stored)	11.70	11.80	12.40	11.50
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.81	1.75	1.78	1.82
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.75	0.75	0.76	0.78

[1] Excludes B and trailing A units.



● The Erie Railroad is known as "The Route of the Perishables," carrying fresh foods to New York's millions. The key to Erie's streamlined, perishable-handling system is their hot-shot fruit express "NY-98."

This famous train highballs through the night over rugged terrain, with brief stopovers for re-icing, in time for New York markets. Hauling this 130-car, fast freight are 6,000 h.p. Diesels, lubricated with Sinclair Gascon Oil, for clean, smooth, dependable operation.

Practically all of America's top railroads have discovered they can get the last word in long, reliable service from their costly Diesels — with Sinclair Gascon® Oils.

SINCLAIR REFINING COMPANY, Railway Sales
New York • Chicago • St. Louis • Houston



SINCLAIR

(*Continued from page* 108)

Insisting that the diesel locomotive is meeting the difficult requirements of modern railroading and that the trend to dieselization will continue, Mr. Bloss said that some improvements must be made. Among these he listed provision for fast warm-up, prevention or reduction of oil leaks, protection against rain, snow, dirt, and dust, and ready accessibility to facilitate maintenance.

U.P. Plans $5.6 Million Diesel Repair Shop

WORK has begun on a new main diesel repair shop for the Union Pacific at Salt Lake City, Utah. The structure has been estimated to cost $5.6 million. It is being erected on the approximate site of a dismantled engine house.

The building will include all equipment and machinery necessary for maintenance and repair of both diesel and gas-turbine-electric locomotives. The main structure will be 410 ft by 162 ft and there will be two wings, one 220 ft by 102 ft and the other 303 ft by 80 ft. The building will have five different elevations ranging from 25 ft to 65 ft in height. It will be built of reinforced concrete, concrete blocks and glass blocks.

Basic shop equipment will include a 250-ton overhead crane capable of lifting the gas-turbine locomotives (which are heavier than present diesel units) and a 90-ton drop-pit table. There will be seven servicing tracks equipped with elevated platforms at engine floor level and depressed pits below the tracks.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE NOVEMBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horsepower	Service	Builder
Florida East Coast	5[1]	1,500	Freight	Electro-Motive
Seaboard Air Line	10[2]	....	.....	Baldwin-Westinghouse
Southern	100[3]	....	.....	Alco-G. E.; Baldwin-Westinghouse; Electro-Motive
Spokane, Portland & Seattle	8[4]	1,600	Road switch	Alco-G. E.

STEAM LOCOMOTIVE ORDERS

Road	No. of locos.	Type	Builder
Norfolk & Western	15[5]	0-8-0	Company shops

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Barrett Div., Allied Chemical Dye Corp.	100	12,500 gal. tank	American Car & Fdry.
Chicago, Burlington & Quincy	2,500[6]	50-ton box	Company shops
	750[6]	70-ton hopper	Company shops
Chicago, Rock Island & Pacific	200[7]	70-ton covered hoppers	Pullman-Standard
Great Northern	95[8]	Flat	Company shops
	15[8]	Caboose	Company shops
Missouri-Kansas-Texas	500	70-ton hopper	Pressed Steel
New York Central	6[9]	125-ton flat	Despatch Shops
	4[9]	170-ton flat	Despatch Shops
New York, Susquehanna & Western	35	50-ton PS-1 box	Pullman-Standard
Union Tank Car Co.	400	50-ton tank	Company shops

FREIGHT-CAR INQUIRIES

Western Maryland	750	55-ton hopper
	250	50-ton box

[1] Approximate cost $888,140. Delivery scheduled for this month.
[2] Approximate cost $1,182,000. Delivery scheduled for the first quarter of 1952.
[3] Delivery expected during 1952.
[4] Estimated cost, $1,185,160. Delivery scheduled for January.
[5] To cost approximately $1,500,000. Delivery scheduled to begin during the second quarter of 1952.
[6] Production and delivery contingent on availability of materials.
[7] Estimated cost $1,400,000. Delivery expected about October, 1952.
[8] Caboose cars, completed in October, cost approximately $131,000. The flat cars, to be delivered this month, cost approximately $20,000.
[9] The smaller cars, to cost $170,010, scheduled for delivery in March and April. The larger cars, to cost $174,928, scheduled for delivery in April and May.

NOTES:

Chesapeake & Ohio.—The board of directors of the C & O has authorized purchase of 1,000 hopper cars at an approximate cost of $6,000,000.

Fruit Growers Express Company.—The company is considering purchase of 1,000 50-ton refrigerator cars.

Great Northern.—The Great Northern has received authority from its board of directors to purchase 26 new diesel locomotives, comprising 47 units, at a total cost of $8,150,000. The units authorized include 15 1,500-hp. road-switchers, two 3,000-hp. road passenger, seven 4,500-hp. road freight, one 3,000-hp. for freight and one 6,400-hp. road freight locomotive.

Louisville & Nashville.—The L. & N. has not ordered 250 50-ton box cars, as erroneously reported in the November table of orders, page 142.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes: System	Foreign	Total	Miles per hot box car set off between division terminals
July, 1950	2,745,932,894	.....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929

SUPPLY TRADE NOTES

KOPPERS COMPANY—*Don C. Smith* has been appointed Pittsburgh district sales manager of the Koppers Company's Wood Preserving division. He is succeeded as sales manager of the division's New York area by *Don F. Taylerson*, who has been a sales representative in the Pittsburgh district office.

◆

NATIONAL CARBON COMPANY.—*Adger S. Johnson*, formerly vice-president and general manager of the National Carbon Company, a division of the *Union Carbide & Carbon Corp.*, has been named president.

Mr. Johnson was born in Charleston, S. C. He is a 1928 graduate of the Virginia Polytechnic Institute with a degree in chemical engineering. Upon graduation he joined National Carbon and in 1933 was assigned to the company's Eveready battery plant in Shanghai, China. He was appointed superintendent of the plant in 1939 but later in that year was recalled to the United States and worked as superintendent at several National Carbon plants. He was appointed assistant to the vice-president in charge of production in 1944, vice-president in charge of foreign plants in 1948, and vice-president and general manager in 1950.

◆

AMERICAN LOCOMOTIVE COMPANY—*Paul N. Strobell*, formerly eastern district manager for Alco-GE locomotive sales and field service, has been appointed assistant to W. A. Callison, vice-president of eastern regional sales, with headquarters at New York. *Ralph M. Darrin, Jr.*, succeeds Mr. Strobell at Schenectady, N. Y. *Frederick Townsend* has been appointed assistant manager, Alco-GE locomotive sales and field service for field service, with headquarters at Schenectady, and *Richard B. Fairman* has been appointed regional renewal parts manager, eastern section, northeast regional renewal parts office, also at Schenectady.

◆

COFFING HOIST COMPANY—*J. R. Coffing*, has been elected vice-president in charge of sales, advertising and general office administration, of the Coffing Hoist Company, Danville, Ill. Mr. Coffing formerly was general sales manager.

◆

SHERWIN-WILLIAMS COMPANY—Sherwin-Williams has created three new transportation sales territories: Northern California, southern California and Ohio-Michigan. *W. R. Clark* has been appointed transportation sales representative for the Ohio-Michigan area, with headquarters in Cleveland. *E. S. Dean* will have charge of the



ON MET-L-WOOD (METAL BONDED TO PLYWOOD) USES

MAJOR manufacturers of diesel locomotives use Met-L-Wood doors and exterior side panels for the same reasons, listed at right, that make Met-L-Wood the ideal construction material for many additional railroad uses. Interior panels, bulkheads, heading, wainscoting, doors, luggage shelves, cabinets, table tops, baggage-car messenger accommodation units...All gain beauty, strength and utility when they are made lighter with Met-L-Wood.

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These are the Advantages of MET-L-WOOD for Railroad Uses

- **WEIGHT SAVINGS** with Met-L-Wood are as high as 73% over steel construction of equal strength!
- **STIFFNESS** of Met-L-Wood Type 2P2-3/8" thickness is the same as that of solid steel plate 1/4" thick!
- **INSULATION** and **SOUND-DEADENING** qualities of Met-L-Wood cut costs and deadweight still further by making less insulation material necessary.
- **INHERENT BEAUTY** of Met-L-Wood's smooth, tough surfaces adds aesthetic value to rugged durability.
- **FAST ASSEMBLY** of prefabricated Met-L-Wood doors and panels cuts manufacturing costs without sacrificing quality. Standard Met-L-Wood sections can be formed, sawed, tapped, drilled, brazed or soldered without special tools or skills.



MET-L-WOOD CORPORATION

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MET-L-WOOD • *STRONG...LIGHT...Smooth Finish...Sound Deadening...Fire-Resisting...Insulating*

northern California area, working out of Oakland, and the southern California territory will be under *T. A. Jordan*, in Los Angeles.

◆

DEVILBISS COMPANY—*D. V. Perry*, eastern district manager of the DeVilbiss Company, has been named assistant sales manager of the company's spray painting and finishing division at Toledo. *C. B.*



D. V. Perry

Gracely, manager of the DeVilbiss office at Houston, has been appointed eastern district manager, with headquarters at Newark, N. J. Mr. Gracely will supervise sales activities in the eastern territory



C. B. Gracely

which includes the New England States, New York, New Jersey, Delaware, Maryland, the eastern part of Pennsylvania and a large section of Virginia.

◆

AIR-MAZE CORPORATION—The Air-Maze Corporation, Cleveland, Ohio, has purchased the *Detroit Air Filter Company*, Woodstock, Ill.

◆

AMERICAN BRAKE SHOE COMPANY.—*William M. Black* has been named president, and *Joseph L. Mullin* vice-president, of Electro-Alloys Division, American Brake Shoe Company. Walter G. Hoffman, formerly president of Electro-Alloys Division has been appointed assistant to the vice-president for Research and Development at Mahwah, N.J. Mr. Mullin will continue also as vice-president in charge of operations for the Manganese Steel Division of the Company.

◆

DEARBORN CHEMICAL COMPANY, LTD.—*Dr. William A. James* has been appointed director of research, and *Jerry Shaw* as sales representative of Dearborn Chemical Company, Ltd. Dr. James will assume charge of all research activities at the Dearborn laboratories, 2454 Dundas street, west, Toronto. For the time being Mr. Shaw will also have headquarters at Toronto.

◆

NATIONAL STEEL CAR CORPORATION—*A. Van Hassel*, a vice-president and director of the National Steel Car Corporation, Hamilton, Ont., since 1942, has been elected president to succeed the late *Robert S. Hart*. *O. H. Anderson*, chief mechanical engineer since 1925 and a vice-president



A. Van Hassel

since 1942, has been elected a director and also has been appointed managing director. Mr. Van Hassel also is president of the Magor Car Corporation of New York.

◆

CHICAGO STEEL SERVICE COMPANY—The Chicago Steel Service Company has opened new general offices and warehouse at Kildare avenue and 45th street, Chicago. The one-story steel frame structure covers 120,000 sq. ft. and cost $1,500,000 to build.

◆

GUSTIN-BACON MANUFACTURING COMPANY—Gustin-Bacon has opened a new sales office and warehouse facility in Houston, Tex., at 5531 Armour Drive. The new warehouse will house Houston division operations of the company's oil field, industrial, insulation and fire fighting equipment business. *Paul O. Craig* has been appointed manager of the Houston division, and *H. M. Stone* will continue as branch manager there.

◆

LANDIS TOOL COMPANY.—The Detroit branch office of the Landis Tool Company, Waynesboro, Pa., has been moved to 17151 Wyoming avenue, Detroit 21.

The former address was 411 New Center building.

RAILWAY TRUCK CORPORATION—*Clarence W. Osner* has become associated with the sales department of the Railway Truck Corporation at Chicago.

◆

VAPOR HEATING CORPORATION.—*J. T. Elwood*, who has been appointed sales representative of Vapor at Chicago as announced in the November issue succeeds *Dave J. Jones*, deceased. Mr. Elwood will handle sales of Vapor-Clarkson steam generators and other equipment the company makes for the locomotive builders.



J. T. Elwood

Mr. Elwood has been with Vapor tor ten years except for service time as a Navy flying officer, and has worked with railroads all over the country out of the company's Chicago office, St. Louis, and Houston.

◆

FAIRBANKS, MORSE & CO.—*D. C. Prescott*, formerly St. Louis district manager of locomotive sales for Fairbanks, Morse & Co., has been appointed middle western regional sales manager, with headquarters at Chicago. His territory will in-

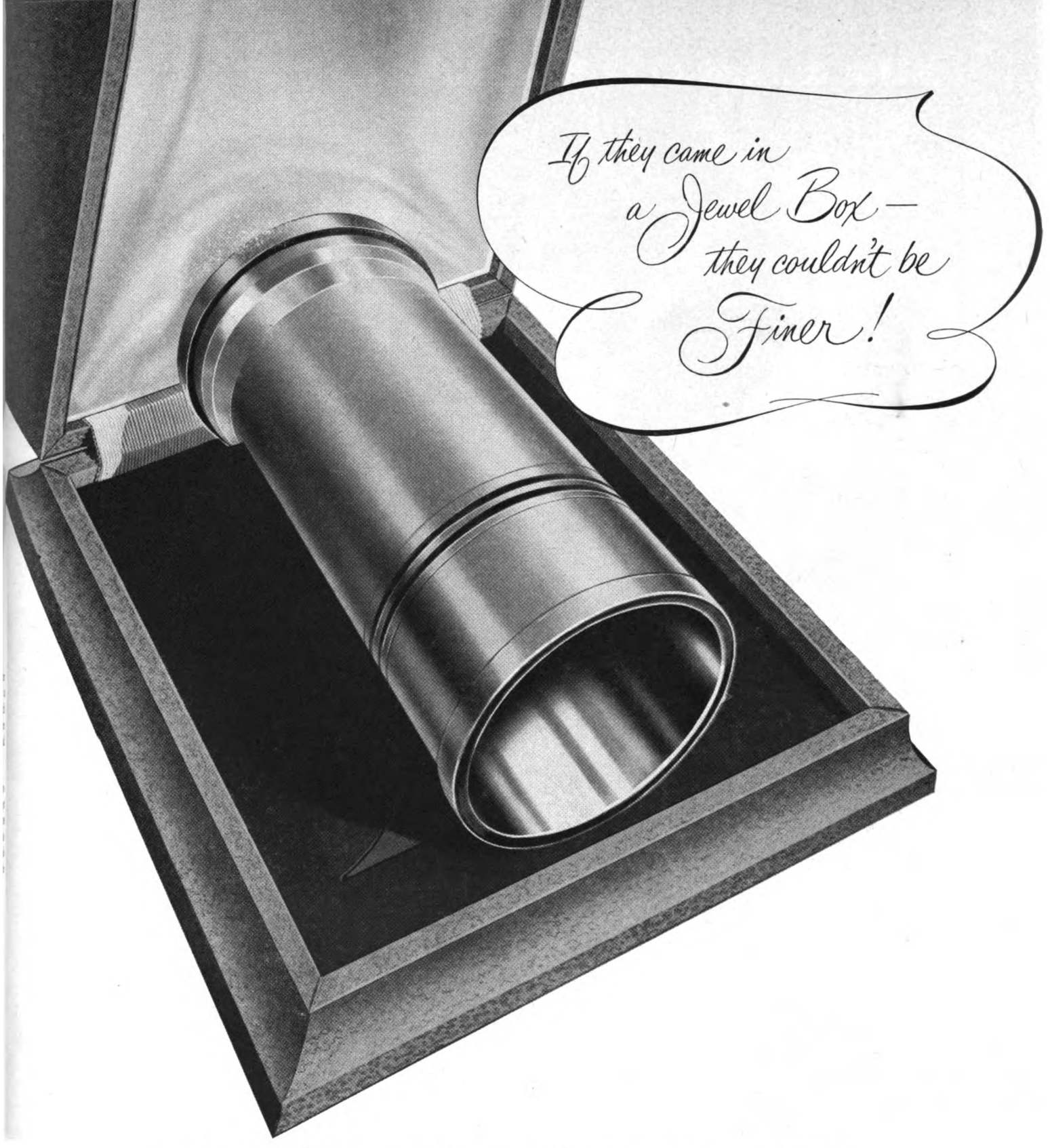


D. C. Prescott

clude St. Paul, Minneapolis and St. Louis. Mr. Prescott was with the Baldwin-Lima-Hamilton Corporation and the Union Pacific before he joined Fairbanks, Morse in 1949.

◆

HOMESTEAD VALVE MANUFACTURING CO—*Railroad Supply & Equipment, Inc.*, has been appointed exclusive distributor of



use *genuine* BALDWIN DIESEL PARTS

BALDWIN DIESEL CYLINDER LINERS are chrome plated to give extra service. Little wonder users report finer performance and longer wear—frequently four times normal. Seven conveniently located warehouses offer fast service on these cylinder liners as well as on other Baldwin Diesel Parts.

BALDWIN
BLH

BALDWIN-LIMA-HAMILTON



Emergency! Plastic tape saves charred motor leads

Burned and blistered motor leads—cracked wide open, and no replacement trucks available! How to get the big road Diesel back on the job fast? Strip down the leads and wrap with "SCOTCH" No. 33 Electrical Tape. That's what Rock Island electricians did recently, and the results were surprising.

The tape, applied in an emergency, lasted through 300,000 miles of continuous service—even in a 90 mph undercar air blast. Never a single failure.

This same stick-at-a-touch tape safeguards hundreds of other installations, too. Plastic backing is unaffected by water, oil, alkalies, acids, weathering. Dielectric strength of 10,000 volts gives extra high insulation protection, yet tape is super-thin for neat, compact results.

Try it today and see! Your jobber can supply you.



REG. U.S. PAT. OFF.
SCOTCH
BRAND
Electrical Tape
No. 33

ASK FOR FREE BOOKLET E-RR. See how you can save with the *right* tape for the job! For your copy, write: Minnesota Mining & Manufacturing Co., Dept. RM-121, St. Paul 6, Minnesota.

The term "SCOTCH" and the plaid design are registered trademarks for the more than 100 pressure-sensitive adhesive tapes made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives.
General Export: Minnesota Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y.
In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

the Homestead company's Hypressure Jenny steam cleaner.

◆

AMERICAN CAR & FOUNDRY CO.—*Robert M. Hoel,* has been appointed sales agent for the American Car & Foundry at Chicago, reporting to J. H. Van Moss, western sales manager. Mr. Hoel, who has been with the company's sales department since



R. M. Hoel

1946, will represent the company in general railroad sales throughout the midwest.

Joseph T. McNally who has been appointed sales agent in the New York district sales office. Mr. MmNally formerly worked for the Shippers' Car Line Corporation and the American Welding Com-



J. T. McNally

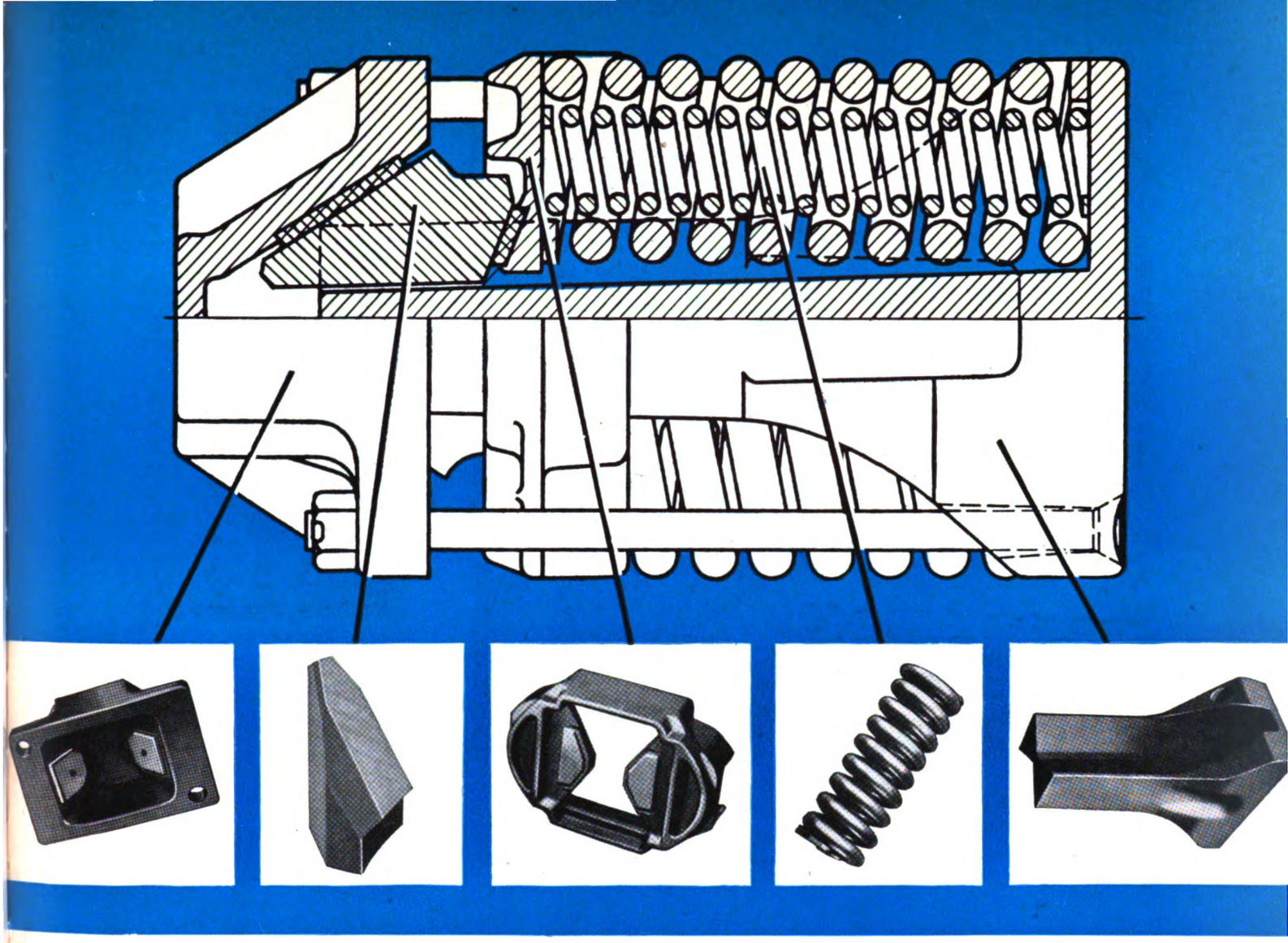
pany, both A.C.F. subsidiaries. He has been assistant manager of tank car sales for the parent company since 1946 and in his new position will specialize in tank-car and miscellaneous sales.

◆

AIR-MAZE CORPORATION—The Air-Maze Corporation, Cleveland, Ohio, has purchased the *Detroit Air Filter Company* of Woodstock, Illinois. The manufacture of Detroit, Arco and Dustay filters will be continued at Woodstock.

◆

TURCO PRODUCTS, INC.—*Archie K. Beard* has been appointed midwest sales manager of Turco Products. Mr. Beard, formerly district manager in Cleveland,, has been transferred to Chicago, where the organization's Chicago-Cleveland operation will now be consolidated. *Harold P. Glavin*



Why the National M-17-A is outstanding!

...Report No. 950 on AAR Five and Twelve Year Tests

● Our Report No. 950 (taken from Circular No. DV-1215, Annual Report of the AAR Committee on Couplers and Draft Gears) gives in detail some of the success of the National M-17-A Friction Draft Gear. A brief summary of the AAR Committee's conclusions shows how this gear gives outstanding performance in providing maximum car protection.

The report points out that in both the five and twelve year tests "externally these gears appeared in good shape... internally there was no detectable wear... the wedging surfaces were all nicely polished... friction surfaces all had nearly 100% contact and all surfaces were fairly straight."

And the report shows that after twelve years of service, the average capacity of the gears tested was still 37% above the AAR minimum of 18,000 foot-pounds required of new gears.

The National M-17-A gear stood up well on these tests because of its rugged design of inwardly acting wedge pressure against a centrally located friction member. Alloy steel castings with machined, ground and hardened friction surfaces assure accurate fit and long wear life.

A-3938

Write today for your copy of Report Number 950 on AAR five and twelve year tests: **National Malleable & Steel Castings Company, 10600 Quincy Avenue, Cleveland 6, Ohio.**

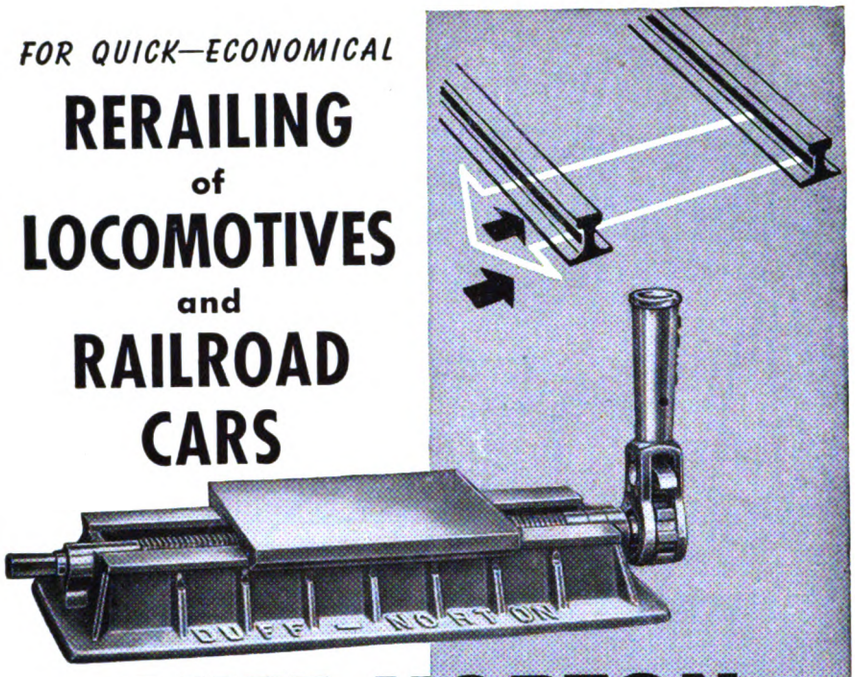
NATIONAL Products FOR TRANSPORTATION AND INDUSTRY

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

RS ● JC

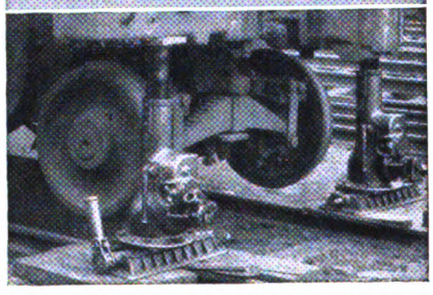
FOR QUICK—ECONOMICAL

RERAILING of LOCOMOTIVES and RAILROAD CARS



DUFF-NORTON TRAVERSING BASES

Emergency rerailing of Diesel, steam, electric locomotives and railroad cars . . . is safe, simple and low in cost, with Duff-Norton Traversing Bases. Carried on wreck trains in units of two bases and two jacks, they eliminate the need for expensive cranes and are always available for any rerailing job.



Traversing Bases and Jacks are placed under load, for rerailing locomotives and cars.

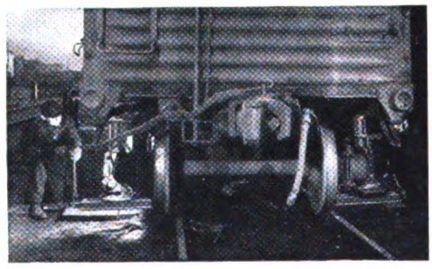
QUICK DATA ON TRAVERSING BASES

Jack No.	Capacity Tons	Height Inches	Horizontal Travel Inches	Weight Pounds	Size of Plate Inches
39-TB	35	3¾	15	85	12 dia.
*40-TB	50	4	15	106	10 x 12
41-TB	50-75	4	20	140	14 dia.

*No. 40-TB can also be furnished for 26" horizontal movement on special order.

No. 40-TB furnished with wooden operating lever 1 1/16" x 24" long.

Nos. 39-TB and 41-TB supplied with steel operating lever 1" x 24" long.



Freight car is lifted and moved horizontally until wheels are aligned with rails. Jacks are lowered to complete rerailing job.

DUFF-NORTON JACKS — STRENGTH, SAFETY, DURABILITY — ESTABLISHED 1883

For Jacks Used With Traversing Bases . . . Write for Your Copy of Bulletin AD-4-R.

THE DUFF-NORTON MANUFACTURING CO.

Main Plant and General Offices, PITTSBURGH 30, PA. Canadian Plant, TORONTO 6, ONT.

"The House that Jacks Built"

has been appointed general manager, Midwest Division factory of Turco, with headquarters in Rockdale, Ill.

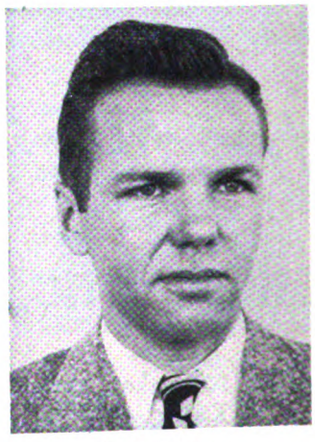
Mr. Beard joined Turco as a technical service engineer in September 1945 and assumed the Cleveland district managership in January 1948. He is a graduate Chemical Engineer from Arizona State College and the University of Southern California. He spent six years as an instructor of Physics and Chemistry at Jerome, Ariz., High School, and during World War II was supervisor of the Chemical and Metallurgical Laboratory for the Goodyear Aircraft Company.



A. K. Beard

◆

BALDWIN-LIMA-HAMILTON CORPORATION. —*H. A. Nielsen*, has been placed in charge of the new Los Angeles sub-office recently opened by the Baldwin-Lima-Hamilton Corporation in the Pacific Electric building, 610 South Main Street. Mr. Nielsen formerly was assistant to the district manager at San Francisco.



H. A. Nielsen

◆

GENERAL ELECTRIC COMPANY—*B. C. Tracey*, manager of accessories and renewal parts sales of the welding department of General Electric Company, has retired. Mr. Tracey joined General Electric in 1918 and was appointed manager in 1948.

◆

CUMMINS ENGINE COMPANY—*R. A. D'Amour* and *G. W. Plondke*, formerly sales engineers for the Cummins Engine

Lasts as long as the car!

"M-F" Threshold Plate

is a structural and wear member permanently welded in place...

The floor boards do not pass under the "M-F" Plate... a feature which greatly increases the ease of removing and replacing floor boards.

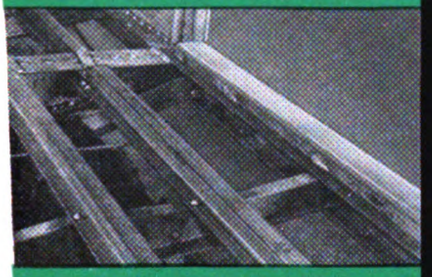
The "M-F" Threshold Plate has a formed section which is welded in place, materially strengthening the sill of a box car.

The "M-F" Threshold Plate produces a smooth and clean floor, without bolt heads in the doorway.

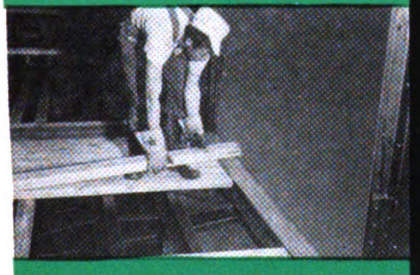
"M-F" Threshold Plates will last as long as the car.



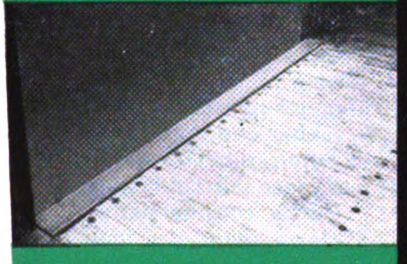
Threshold Plate being placed in position.



Threshold Plate welded to door post and side sill.



Floor boards being placed.



Floor boards bolted down.

"M-F" PRODUCTS

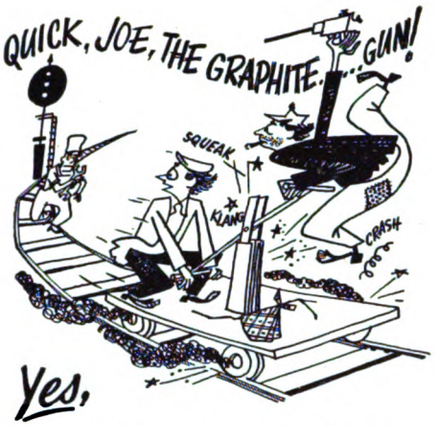
Water-Tight Bolts
Lock Nuts • Collar Bolts
Floor Clips • Threshold Plates



Floor boards are easily removed... easily replaced.

MAC LEAN-FOGG LOCK NUT COMPANY

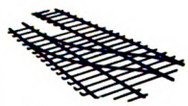
5535 North Wolcott Avenue, Chicago 40, Illinois • ***In Canada: The Holden Co., Ltd., Montreal***



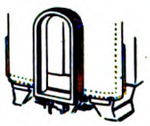
Yes, everything works better with Dixon Graphite!

FOR EXAMPLE:

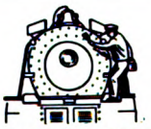

PANTAGRAPHS eliminates friction


SWITCH PLATES no dirt pick-up


CENTER PLATES won't squeeze out

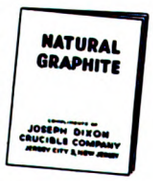

DIAPHRAMS won't wash off


PIPE JOINT COMPOUND stays flexible


ENGINE FRONT FINISH resists heat

Dixon *Natural* Graphite is unaffected by extremes of temperature —is inert, won't wash off or squeeze out under pressure – doesn't pick up road dirt or dust. For real operating economy use Dixon wherever you have a tough maintenance problem.

SEND FOR FREE SAMPLE of Dixon 1924 – Quick Drying Lubricant. Try it – it's an effective, long lasting dry lubricant, superior to oil and grease for many applications. Also, ask for your copy of technical report "Natural Graphite." Joseph Dixon Crucible Company, Jersey City 3, N. J.



DIXON
NATURAL GRAPHITE

• 1924 Quick Drying Lubricant • Center Plate Lubricant • Graphite Seal • Pipe Joint Compound • Brake Cylinder Lubricant • Engine Front Finish • Graphite for Compounding • Lathe Center Lube

Company, Columbus, Ind., have been appointed assistant regional managers, Washington, D. C. region and Central region, respectively.

◆

PEERLESS EQUIPMENT COMPANY.—*Charles F. Palmer* has been elected president of Peerless Equipment Company, a subsidiary.



Charles F. Palmer

of Poor & Co., succeeding *William E. Gray*, who has resigned. Mr. Palmer's headquarters are in Chicago.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY—*T. H. Way*, has been appointed assistant vice-president of the



T. H. Way

Pullman-Standard. Mr. Way will have charge of manufacturing at the Hammond, Ind., and Rockford, Ill. plants.

◆

PRECO, INC.—Preco, Inc., Los Angeles, Cal., has appointed *Electra Motors*, Anaheim, Cal., to develop and supply the small electric motors and accessory equipment, such as pulleys and V-belts, used in precooling refrigerator cars equipped with Preco fans.

◆

DEDNOX, INC.—*Constant C. Hopkins*, owner of the *Constant Hopkins Company*, has been elected vice-president of Dednox, Inc. *Michael W. Neal*, who has been head of the Dednox service department, has been appointed sales engineer. Together they will collaborate with the *Spring Packing Corporation*, exclusive distributor of Dednox to railroads. Mr. Hopkins has

below 800° F.

Accurate

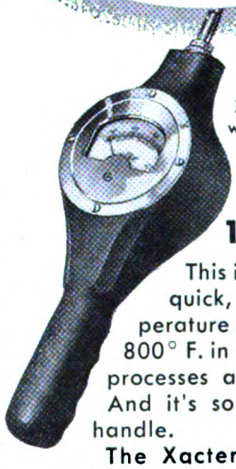
TEMPERATURE READINGS

in a few seconds . . .

XACTEMP

Low Temperature · General Purpose

HAND PYROMETER



Type LT-840
Low temperature Xactemp Pyrometer with rigid extension arm and surface tip thermocouple.

1001 USES

This is the answer to quick, accurate temperature readings below 800° F. in many industrial processes and operations. And it's so convenient to handle.

The Xactemp hand-type pyrometer, Model LT-840, is used with needle thermocouples, ribbon thermocouple, surface tip thermocouple, and other specially designed thermocouples and extension arms. These are easily interchangeable and, without adjustments or recalibration of the instrument, quickly ready it for measuring the surface temperature of stationary and revolving rolls and cylinders, flat and irregular surfaces of molds, dies, etc. in rubber and paper making, plastic materials, rubber, wax, oils, greases, and other semifluid materials.

Handy, compact design makes this Xactemp pyrometer ideal for field service, laboratory, and production-line use.

***Price** Xactemp Pyrometer less thermocouples $51.50*

Write for detailed, descriptive literature on Gordon Xactemp Pyrometers.

GORDON SERVICE

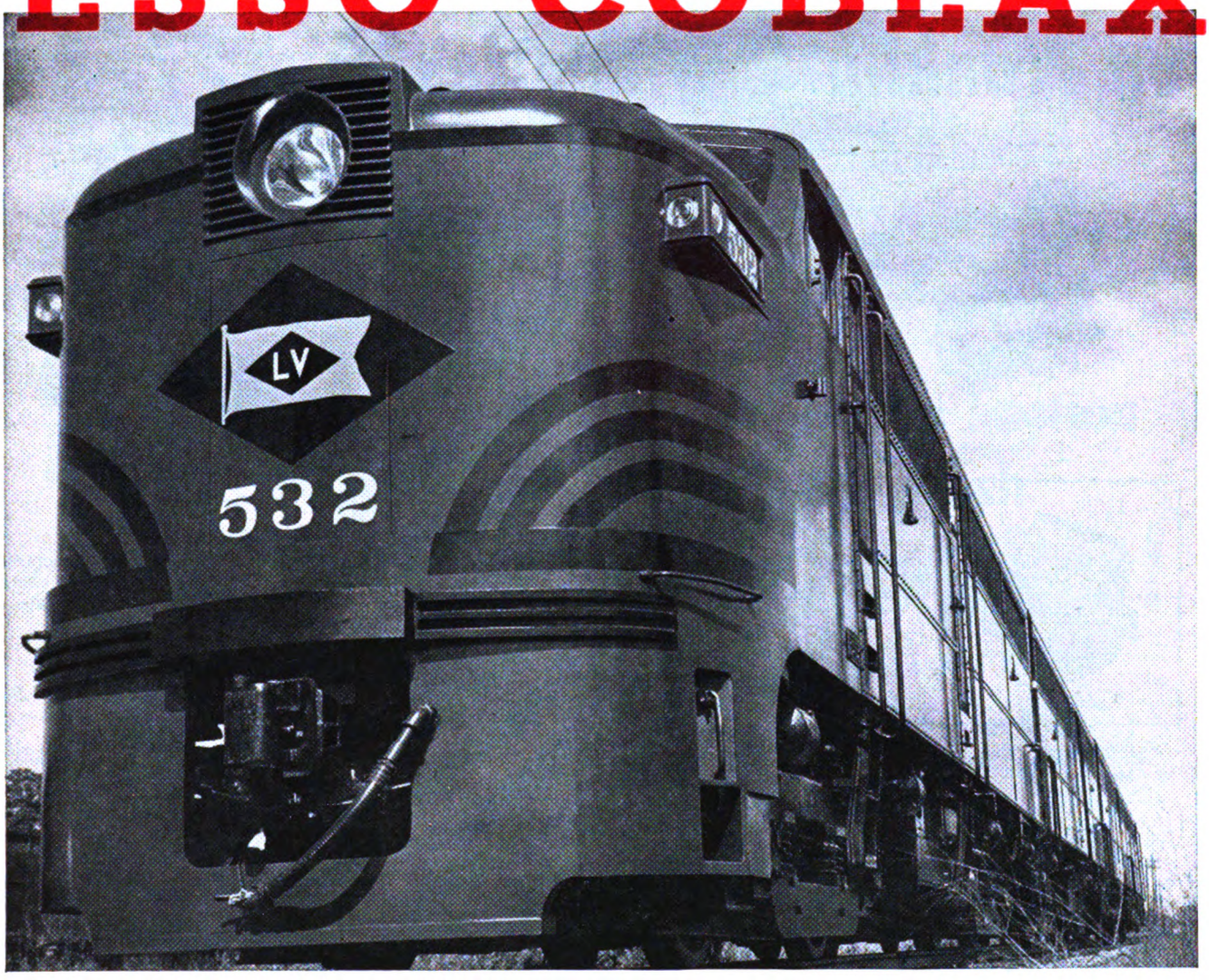
CLAUD S. GORDON CO.

Manufacturers & Distributors

Thermocouple Supplies • Industrial Furnaces & Ovens
Pyrometers & Controls • Metallurgical Testing Machines

Dept. 12 • 3000 South Wallace St., Chicago 16, Ill.
Dept. 12 • 2035 Hamilton Ave., Cleveland 14, Ohio

ESSO COBLAX



"Tailor-made" to railroad specifications

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

ESSO COBLAX LUBRICANTS

have been specifically developed to provide highly dependable gear lubrication for traction motor drives on electric and diesel-electric locomotives; gas electric and multiple-unit cars; and many other locomotive and car lubrication requirements. Esso COBLAX is availabe in a wide range from fluid oils to semi-solid products... "tailor-made" for railroad applications.

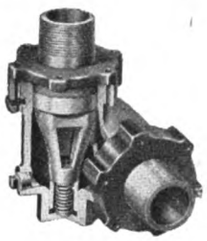
BACKED BY CONSTANT RESEARCH

—keeping pace with latest engine design and developments. Esso Railroad Products are constantly being tested and improved.

BACKED BY CONSTANT FOLLOW-UP

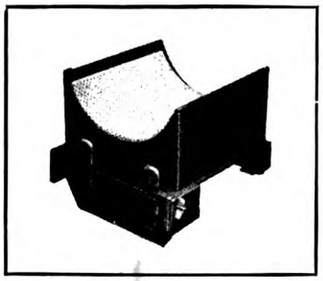
—on-the-job check-ups by Esso Sales Engineers assure dependable performance of Esso Railroad fuels and lubricants! Be sure to call on ESSO for any fuel or lubricating problem.

use Franklin parts on Franklin devices

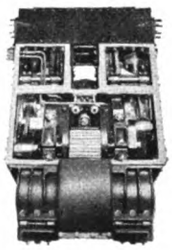


Sleeve Joints

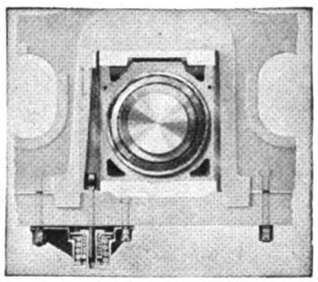
In order to obtain full efficiency from your Franklin devices, specify genuine Franklin parts in replacement. Franklin devices will always perform best when equipped with genuine Franklin parts made to interchangeable tolerances and of the correct materials.



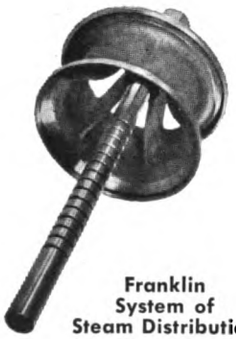
Driving Box Lubricators



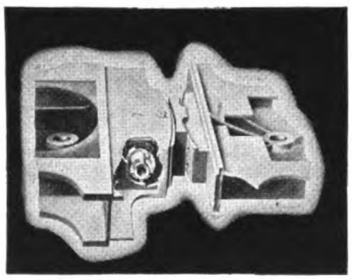
The Locomotive Booster



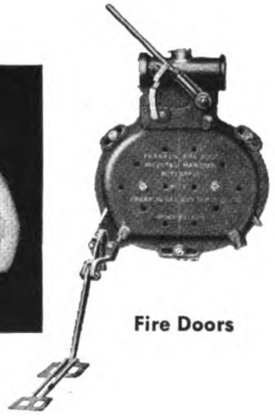
Automatic Compensators & Snubbers



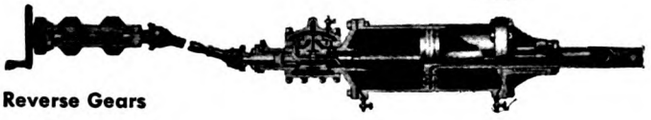
Franklin System of Steam Distribution



Radial Buffers



Fire Doors



Power Reverse Gears

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • TULSA • MONTREAL

STEAM DISTRIBUTION SYSTEM · BOOSTER · RADIAL BUFFER · COMPENSATOR AND SNUBBER
POWER REVERSE GEARS · FIRE DOORS · DRIVING BOX LUBRICATORS · OVERFIRE JETS
JOURNAL BOXES · FLEXIBLE JOINTS · TANK-CAR VALVE

RAILWAY DISTRIBUTOR FOR N.A. STRAND FLEXIBLE SHAFT EQUIPMENT

been associated with the sale of Dednox since its inception.

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY—*N. H. Arnold*, has been appointed sales manager of the Standard Railway Equipment Manufacturing Company. Mr. Arnold will be in charge of development, manufacture and sale of Standard's wheel-truing machine.



H. H. Arnold

Obituary

WILLIAM T. BISSELL, of the Journal Box Servicing Corporation, died on October 8.

DONALD S. BARROWS, who retired as vice-president in charge of engineering for the Symington-Gould Corporation in 1947, died on October 27, at his home in New Haven, Conn. Mr. Barrows, who was 74 years old, joined the T. H. Symington Company, a predecessor of Symington-Gould, as chief engineer, in 1915.

PERSONAL MENTION

General

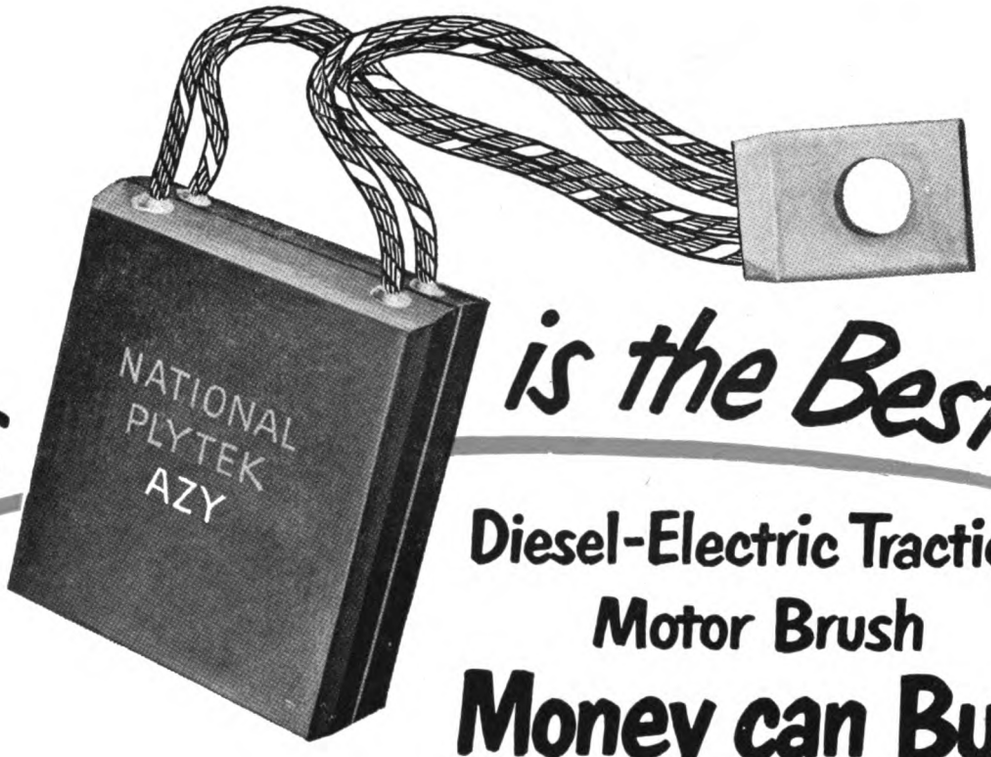
S. T. KUHN, assistant superintendent equipment of the New York Central, Lines West of Buffalo, at Chicago, has been appointed assistant to general superintendent equipment of the system at New York.

PERRY D. HAWKINS, assistant general air brake inspector of the Erie, has been appointed general air brake inspector, with headquarters as before at Cleveland.

GEORGE H. HIGLEY, general air brake inspector of the Erie at Cleveland, has retired under the pension rules of the company after more than 48 years of service.

C. B. CAMP has been appointed superintendent automotive equipment of the Chicago, Rock Island & Pacific at El Reno, Okla.

T. J. LYON, superintendent of equipment (Buffalo and East) for the New York Central at New York, has been appointed



This is the Best Diesel-Electric Traction Motor Brush Money can Buy!

Big Statement? You Bet!

BUT WE CAN BACK IT UP! Into the brush illustrated above, National Carbon Company has built plus factors which make it the finest in the world for its purpose — a brush developed especially for diesel-electric motors. Here's why:

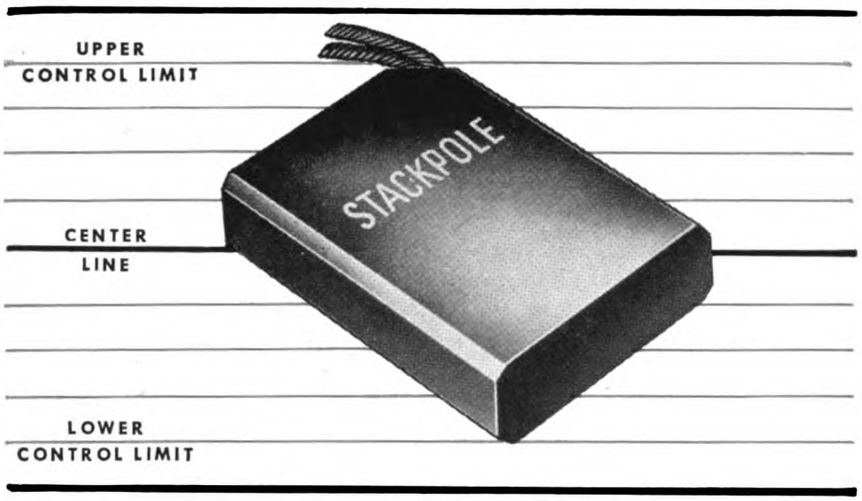
- **"NATIONAL" Grade AZY**—proved by millions of service miles to give longest life with excellent commutator condition, plus remarkable freedom from breakage!
- **"NATIONAL" Permanently-Sealed Shunt Connections** do not pull out. Of millions made to date, *not one pull-out* has ever been reported! These Permanently-Sealed Connections also minimize cable fraying through special internal construction.
- **Exclusive Fray-resistant Cable** gives still further protection, with the result that overall brush dependability is assured!

All three outstanding features available in the following "NATIONAL" STANDARDIZED Brushes

NC 24-7215 — 2 x 2¼ x ¾" (⅜-⅜)
NC 24-5620 — 2 x 1¾ x ¾" (⅜-⅜)
NC 20-6420 — 2⅛ x 2 x ⅝" (5/16-5/16)

The terms "National" and "Plytek" and the Silver Strand Cable device are registered trade-marks of Union Carbide and Carbon Corporation

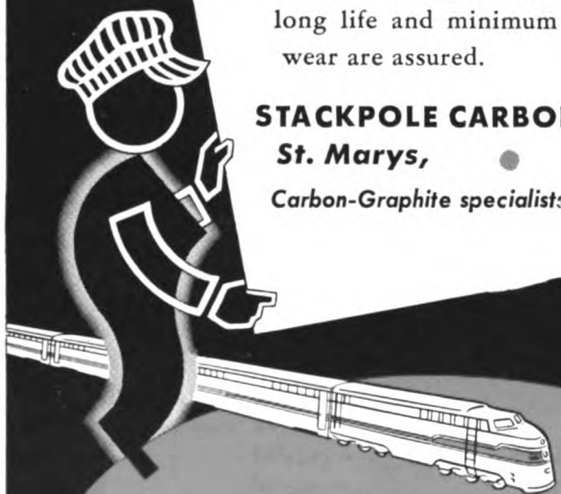
NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
IN CANADA: National Carbon Limited
Montreal, Toronto, Winnipeg



quality controlled...
for uniform dependability

The uniform dependability of Stackpole Diesel Brushes is the direct result of long, specialized experience PLUS statistical Quality Control in every step of production. Stackpole Quality Control means that brush characteristics are kept at highly uniform levels—long life and minimum commutator wear are assured.

STACKPOLE CARBON COMPANY
St. Marys, Pa.
Carbon-Graphite specialists for over 30 years



STACKPOLE
Diesel-Electric
BRUSHES

assistant superintendent of equipment, (West of Buffalo), with headquarters at Chicago. Mr. Lyon has been appointed also superintedent of equipment for the Indiana Harbor Belt and the Chicago River & Indiana.

GEORGE R. ANDERSEN whose appointment as assistant chief mechanical officer of the Chicago & North Western was announced in the November issue, started in 1911 as a car inspector at Milwaukee, later serving as chief car inspector and



George R. Andersen

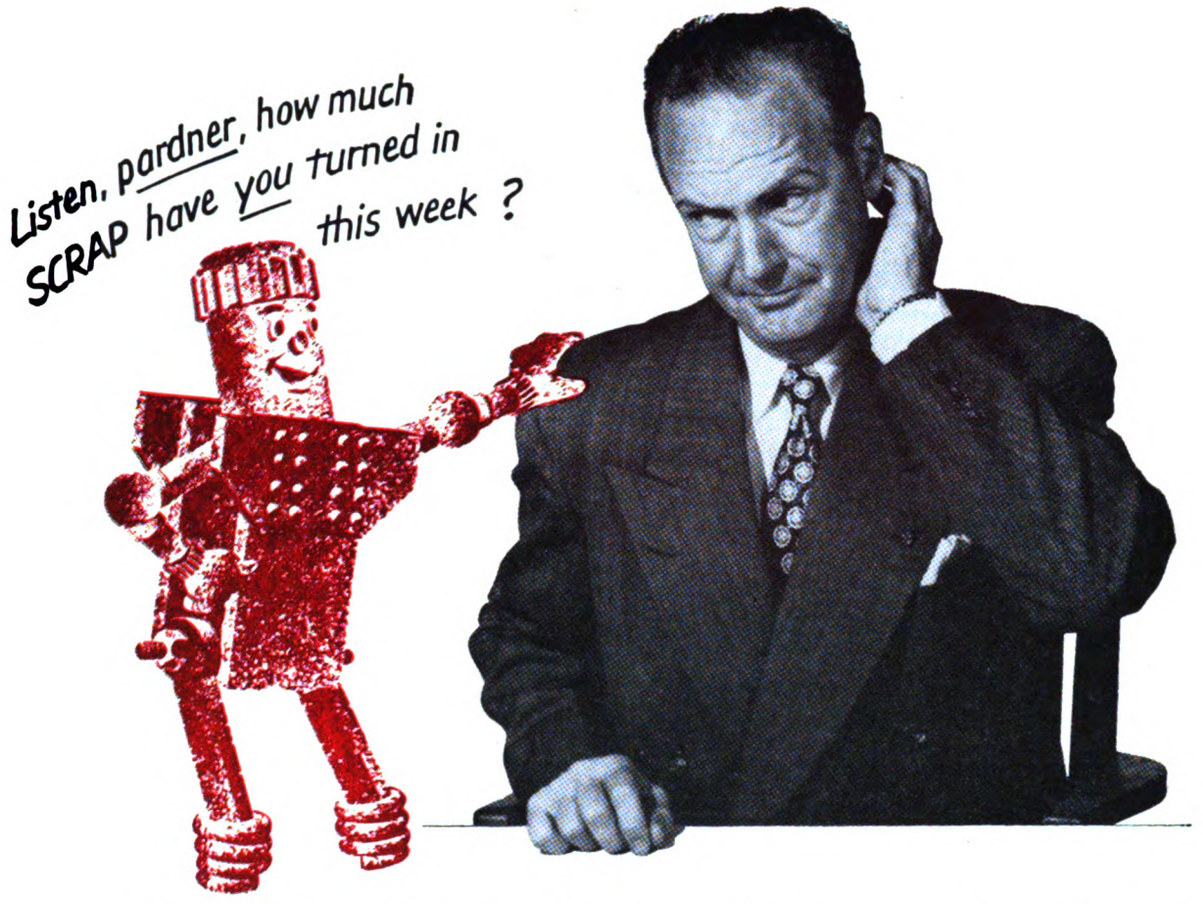
assistant car foreman. In 1920 he was appointed geneeral car foreman at Butler, Wis.; in 1921, assistant master car builder at Chicago, master car builder in 1925, assistant superintendent car department in 1942, and in 1945 superintendent car department at Chicago.

JOHN C. STUMP, whose appointment as chief mechanical officer of the Chicago & North Western was announced in the November issue, began his railroad career with the C. & N. W. in 1912 as a machinist at Eagle Grove, Iowa. He later served in various supervisory positions at Chad-



John C. Stump

ron, Neb., Green Bay, Wis., and New Butler. In 1926 he was appointed assistant superintendent of motive power and machinery at Chicago; in 1939, superintendent of motive power, Western district; in 1944, superintendent of motive power, Northern district, and in 1948, assistant chief mechanical officer.



Today, the steel business is your business

—*it needs all your SCRAP, Now!*

SUPPOSE that every steel user were suddenly told that he had to turn in a half-ton of scrap before he could get a ton of steel. It would start the most gosh-almighty treasure hunt for scrap that ever happened.

In effect, this "no-scrap, no-steel" situation virtually exists. For without *all* the scrap that industry can search out and start on its way to the mills, steel production will surely drop. It's as serious as that.

More scrap is urgently needed. Today the mills are turning out more steel than ever before. But they're scraping the bottom of the barrel as far as scrap is concerned. Defense and domestic demands for steel simply cannot be met unless at least 100,000 tons of "purchased" scrap roll into the furnaces—*every day*.

The bulk of this scrap must come from industry. That's why we're asking for your all-out help. That's why it's so important that you make the drive for scrap part of your daily operations. Make it your business to encourage every employee to report any obsolete, broken or worn-out machinery, tool or equipment that has seen its day. From this dormant "junk" must come the heavy melting scrap that the mills need most. Don't let your scrap lie idle; send it on its way. How about it, pardner?

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

This page would ordinarily be used to tell you about

AMERICAN TIGER BRAND WIRE ROPE

but, because without SCRAP we cannot produce steel, we are asking instead for your all-out help in getting more SCRAP to the mills.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TRADE MARK

1-1326

UNITED STATES STEEL

C. H. GRAY has been appointed superintendent motive power of the Chicago Rock Island & Pacific at El Reno, Okla.

G. W. NELSON, assistant master mechanic of the New York Central at Syracuse, N. Y., has been appointed special assistant to manager equipment at New York.

E. R. BATTLEY, chief of motive power and car equipment of the Canadian National at Montreal, has retired after nearly half a century of railroad service. Mr. Battley was born at Stratford, Ont., on October 21, 1886, and entered railroad service in December 1902 as a machinist apprentice with the Grand Trunk (now C.N.) at Stratford. He subsequently served as machinist, inspector, locomotive foreman. general foreman, master mechanic and superintendent motive power. In 1927, when union-management cooperative committees were being developed on the C.N., Mr. Battley was the machinist member of the committee of experts organized by the railway's Bureau of Economics to study the technical features of the plan which is still in operation today. In 1930 he was appointed assistant general superintendent of motive power at Toronto and in July 1932 he was loaned to the National Railways of Mexico to conduct a study of machine shops and prepare recommendations for these establishments. On his re-



E. R. Battley

turn to Canada, Mr. Battley became superintendent of shop methods at Montreal. In 1933 he was appointed general superintendent in the motive-power and car-equipment department at Toronto and in October 1942 became chief of motive power and car equipment at Montreal.

A. C. MELANSON, works manager of the Canadian National at the Point St. Charles shops at Montreal, has been appointed chief of motive power and car equipment. Mr. Melanson was born at Scoudouc, N. B., and entered railroad service with the Intercolonial (now C.N.) in 1911 as a machinist apprentice in the mechanical department at Moncton, N. B. He subse-



A. C. Melanson

quently served as draftsman, material inspector, and superintendent of motive power and car shops at St. Malo, Que. In February 1939 he became superintendent of motive power and car equipment of the Quebec district and in 1943 superintendent at Toronto. Mr. Melanson was appointed works manager of the Point St. Charles shops in 1944.

Electrical

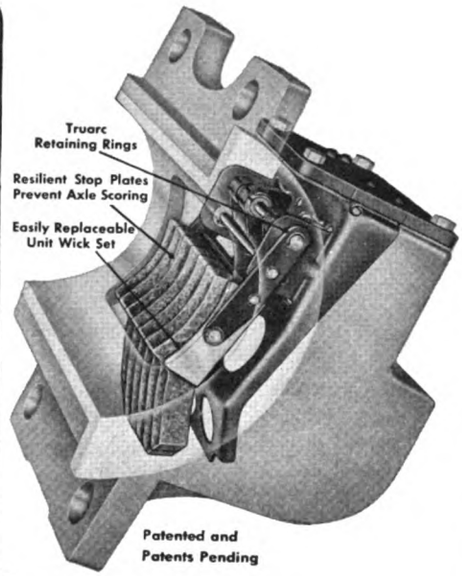
WILLIAM C. CHAPMAN, chief electrical engineer on the Chicago & North Western,



CONTINUOUS SCIENTIFIC LABORATORY DEVELOPMENT



CONSTANT ON-THE-JOB PERFORMANCE TESTS...



Result! **Felpax Lubricators Reduce Support Bearing Maintenance as much as 75%**

INSTANT COMPLETE LUBRICATION with the first turn of the axle under heavy load conditions reduces babbit wipe and consequent early bearing damage. Continuous lubrication under high speeds provided by special felt wicks in constant contact with the journal insures longer bearing life.

MILLIONS OF MILES of trouble-free service on the nation's Class I Railroads have proved Felpax Lubricators provide the lubrication required to keep Today's Modern Traction Motors operating at peak efficiency.

NO OTHER LUBRICATION METHOD provides all these *"Performance Proved"* FEATURES!

- **ELIMINATES** waste packing and the human element involved.
- **SERVICE** reduced to periodic checking and filling oil sump.
- **SPECIAL FELT WICKS** eliminate waste grabs and starved bearings.
- **REPLACEMENT** of worn wick sets after thousands of miles of use is simplified by improved construction (see illustration above).
- **COMPLETE KIT** for replacement containing wick set, springs and necessary hardware available at nominal cost.
- **NO MOVING PARTS** subject to failure due to dirt, moisture and freezing.

For full particulars see your locomotive builder or write to:



MILLER FELPAX CORPORATION
WINONA, MINNESOTA

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT	RPM Delo R.R. Oil
UNIT	Locomotive diesel engines
SERVICE	Freight and passenger
OPERATION	Local and transcontinental
MAINTENANCE	Progressive

One million miles of service from engine parts!

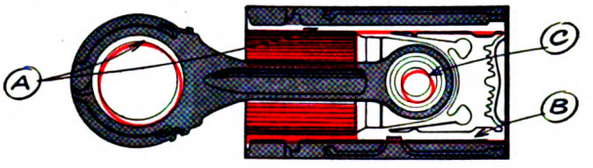
LUBRICATED WITH RPM DELO R.R. OIL, many diesel engines in the locomotives of U.S. railroads have been in service for long periods without complete overhaul! Many of the liners, pistons, bushings and other parts in these engines have now been in use for hundreds of thousands of miles. Progressive maintenance inspections indicate that RPM DELO R.R. Oil will keep the parts in service for at least one million miles, the general overhaul period set by some of the railroads.

RPM DELO R.R. Oil keeps parts clean and free of wear-causing lacquer and gum deposits and is not corrosive to engine metals of any kind.



IN OVERLAND MOUNTAINOUS FREIGHT SERVICE for nearly 500,000 miles, this liner, lubricated with RPM DELO R.R. Oil has less than 0.006 inch wear and taper is so minor that it is barely measurable.

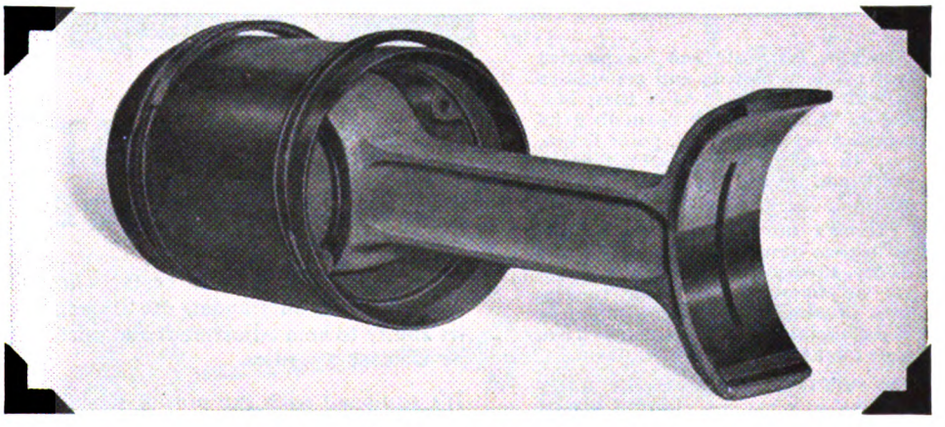
How RPM DELO R.R. Oil prevents wear, corrosion, oxidation



A. Special additive provides metal-adhesion qualities...keeps oil on parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent scuffing of cylinder walls.

C. Special compounds stop corrosion of any bushing or bearing metals and foaming in crankcase.



THIS PISTON AND CONNECTING ROD have been in service for more than four years. After picture was taken it was put back in the engine for further use. Note the excellent condition of the rings and bearing. All the rings are free, oil holes open and there are no troublesome deposits in any ring grooves.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any one of the companies listed below.

RPM DELO LUBRICATING OILS

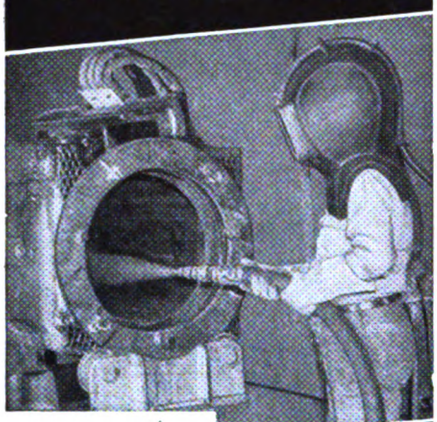
TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street | San Francisco 20, California

THE CALIFORNIA COMPANY
P.O. Box 780 | Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P.O. Box 862 | El Paso, Texas

CLEAN Diesel-Electric Motors Without Solvents





NO Drying Periods, NO Toxic Hazards with NEW Pangborn AC-4 Blast Machine

The new, fast, safe and inexpensive way to clean motors and generators is with a Pangborn AC-4 Blast Machine. Soft, 20-mesh corncob grits whisk away grease, oil, paint flakes, etc., in scouring armatures, frames, coils and other parts. (See photo above.)

There's no danger from caustic action, no time lost waiting for work to dry. Corncob blast machines operate on standard 40-lb. air supply. Cost of materials averages 90% less and cleaning is done in one-third the time it takes to clean with solvents.

FOR FULL INFORMATION write today and tell us what you clean. Address: PANGBORN CORP., 3700 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

has retired after 40 years of service. Mr. Chapman started with the company in 1911 as an electrician at Chicago. He was appointed chief electrician at Clinton, Iowa, in 1914, electrical inspector at Chicago in 1916; assistant electrical engineer in 1927; electrical engineer in 1945 and chief electrical engineer in 1947.

HAROLD T. THEIS has been appointed chief electrical engineer of the Central of New Jersey, reporting to the superintendent motive power and rolling stock. Mr. Theis' headquarters are at Jersey City, N. J.

Master Mechanics and Road Foremen

S. D. DEKLE, assistant mechanical officer of the Seaboard Air Line at Jacksonville, Fla., has been appointed master mechanic of the North Florida division, with headquarters at Jacksonville.

W. L. JONES, master mechanic of the Illinois division of the Illinois Central at Champaign, Ill., has retired after 44 years of service.

G. E. BELL, master mechanic of the Illinois Central at McComb, Miss., has been transferred to the position of master mechanic at Vicksburg.

J. G. CARLTON, master mechanic of the North Florida division of the Seaboard Air Line at Jacksonville, Fla., has been transferred to the Georgia division at Atlanta (Howells), Ga.

R. W. ELLIS, general master mechanic of the Iowa division of the Illinois Central at Waterloo, Iowa, has been appointed master mechanic at Champaign, Ill.

R. W. BALLARD, diesel supervisor of the Illinois Central System at Chicago, has been appointed master mechanic at Jackson, Tenn.

A. BLANKINSHIP, general foreman of the Illinois Central at Johnston shop, Memphis, Tenn., has been appointed to fill the newly created position of master mechanic of the Kentucky division, with headquarters at Paducah, Ky.

V. V. VIAR, general foreman of the Chesapeake & Ohio, Hinton, W. Va., has been appointed master mechanic of the Hinton division.

E. L. WALSTON, general foreman of the Illinois Central at East St. Louis, Ill., has been appointed general master mechanic of the Iowa division with headquarters at Waterloo, Iowa.

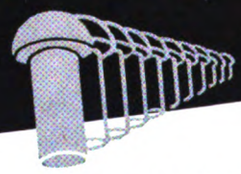
C. L. HALL has been appointed assistant master mechanic of the New York Central at Harmon, N. Y.

VERNON I. MARLO, superintendent of shops of the Atchinson, Topeka & Santa Fe at Barstow, Cal., has been transferred to the position of master mechanic at Argentine, Kan.

W. H. CHIDLEY, master mechanic of the New York Central at Albany, N. Y., has been transferred to New York.

(*Continued on p. 134*)

PROPERLY HEATED RIVETS at a SAVING!



with a JOHNSTON RIVET FORGE!



Save oil, save time, cut costs! The Johnston Rivet Forge is outstanding for its economy, for its ability to hold adjustment and operate steadily without attention.

It's equipped with the proven Johnston non-clogging vacuum oil burner. Because it's engineered with experience there's no oil valve—no small passage to clog! It's available in portable or stationary types. For safety, for dependability, for economy, order the Johnston Rivet Forge!

Write For Bulletin R-801

Over Thirty Years Experience in Design and Manufacture of Burners • Blowers • Furnaces • Rivet Forges • Fire Lighters • Tire Heaters • And Allied Equipment

SAFETY THE JOHNSTON LINE DEPENDABILITY

JOHNSTON MANUFACTURING CO. 2825 EAST HENNEPIN AVE. MINNEAPOLIS 13, MINN

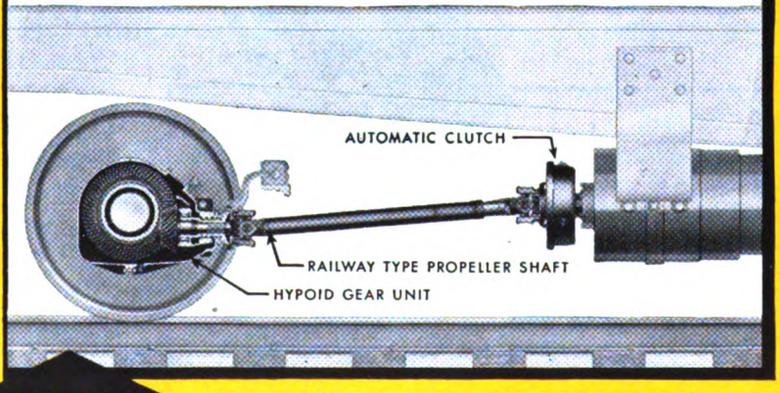
ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

MORE THAN 8000 SPICER *Positive* GENERATOR DRIVES

in operation on 70 different railroads!

The Spicer Railway Generator Drive for lighting, air-conditioning, refrigerating and other electrical equipment consists of a very simple application of long-lived hypoid gear and pinion mounted on the standard axle. The drive from the gears is positive and constant through Spicer Universal Joints and Propeller Shaft to the Spicer Automatic Clutch mounted between the generator and the propeller shaft. This automatic clutch completely absorbs all shocks and disconnects the drive line in case of excessive overload, and also completely disconnects the generator at speeds below 8 miles per hour eliminating shock loads when cars are being shunted.

Spicer Positive Railway Generator Drives can be quickly and economically adapted to new car designs and reconditioning jobs. Write for further details.



46 YEARS OF **Spicer** SERVICE

Positive **GENERATOR DRIVES**

Manufactured, Sold and Serviced by

SPICER MANUFACTURING • *Division of Dana Corp.*

Toledo 1, Ohio

BIDDLE

NUMBER 5 OF A SERIES

Instrument News

ONE PORTABLE TEST KIT FOR MOST ELECTRICAL RESISTANCE MEASUREMENTS

Here is how one railroad uses a Rectifier-Operated Meg Type of Megger® Insulation Tester housed in the same portable carriage with a Ducter® Low Resistance Ohmmeter and a Biddle Power Supply.

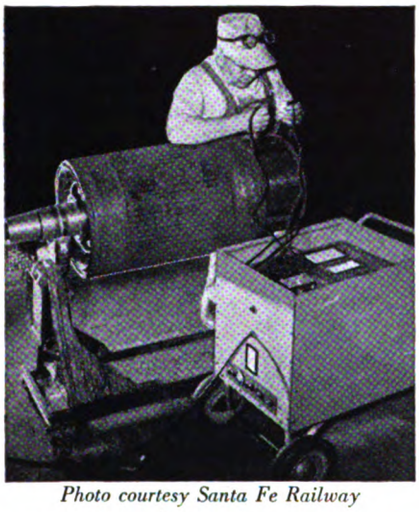


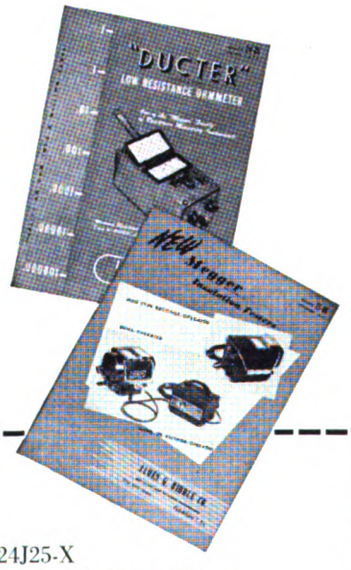
Photo courtesy Santa Fe Railway

The bar-to-bar test on the armature is being made with the Ducter using duplex hand spikes having a current and potential spike in each handle. In general bar-to-bar tests are more for the purpose of equalizing the resistances than for measuring their exact values.

The Ducter ohmmeter, which measures resistances as low as a millionth of an ohm, is invaluable for maintaining normal resistances in the series fields and armature windings of diesel-electric locomotive traction motors, switch contacts, cable joints, etc. Write for our interesting Bulletin 24-25-X or the comprehensive Ducter Manual 24J25-X.

The Rectifier-Operated Meg Type of Megger Insulation Tester is included in the same mobile unit for ready use in testing electric motive and Diesel-electric motive power equipment as well as motors, generators, transformers, etc. These instruments, available in ranges up to 2000 megohms and 1000 volts d-c, are described in Bulletin 21-46-X.

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up-to-date.



JAMES G. BIDDLE CO.
1316 Arch St., Philadelphia 7, Pa.
Please mail me

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JAMES G. BIDDLE CO., 1316 ARCH ST.
PHILADELPHIA 7, PA.

ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

Personal Mention

(*Continued from page* 128)

HAROLD MACKEY, master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed master mechanic at Chicago.

R. J. CHINN has been appointed master mechanic of the Illinois Central at McComb, Miss.

H. W. GLADHILL has been appointed assistant master mechanic of the Hagerstown division of the Western Maryland at Hagerstown, Md.

Diesel

J. S. DUCK has been appointed diesel supervisor of the Illinois Central System, with headquarters at Chicago.

Car

G. S. GLAIBER, assistant superintendent equipment of the New York Central, Lines Buffalo and East, has been appointed general car inspector of the system, with headquarters as before at New York.

WALTER C. BARRER, whose appointment as superintendent car department of the Chicago & North Western at Chicago was announced in the November issue, began as a car inspector on the C. & N. W., in 1915. After military service in World War I, he returned to the railroad in



Walter C. Barrer

1919 as a car inspector and later held various positions until 1925 when he became assistant foreman, Chicago shops. In 1942 he was appointed general foreman at the California Avenue shop; in 1944, district superintendent car maintenance, and, in 1945 assistant superintendent, car shops.

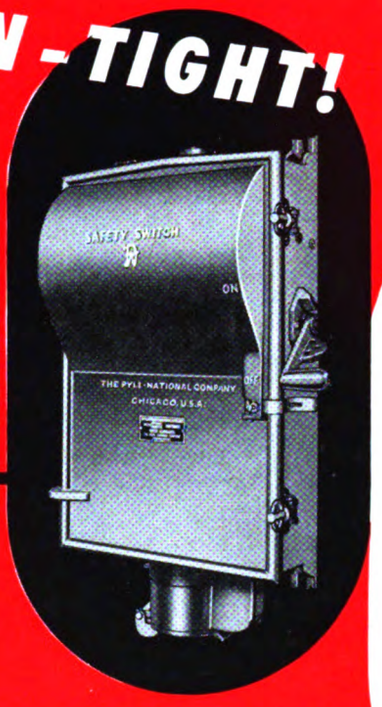
V. G. SMALL, assistant superintendent of car department for the Elgin, Joliet & Eastern, at Joliet, Ill., has been appointed superintendent of car department, with headquarters at the same point. He succeeds *W. A. Emerson*, retired after 50 years of service.

Obituary

HUGH H. DAVENPORT, general car inspector, eastern lines, Chicago, Burlington & Quincy, died November 6 in Aurora, Ill.

Heavy Duty Safety Switch, and Circuit Breaker

RAIN-TIGHT! DUST-TIGHT!

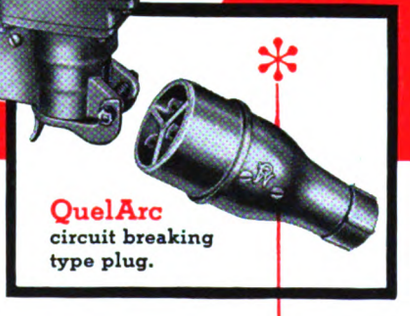


RAIN-TIGHT SAFETY SWITCHES with receptacle, fusible or fuseless, ratings up to 100 amps. 600 volts . . . without receptacle, up to 200 amps. 600 volts. (NEMA TYPES V, IV and III)



DUST-TIGHT AND RAIN-TIGHT CIRCUIT BREAKERS with receptacle, ratings up to 100 amps. 600 volts . . . without receptacle, up to 225 amps. 600 volts. Dust-tight types for hazardous locations, Class II, group E, F, and G. (NEMA TYPES IX, V, IV and III)

PYLETS



QuelArc circuit breaking type plug.

. . . designed for Safe, Reliable Operation and Protection of Portable and Stationary Electrical Equipment, ***indoors and outdoors, in Railroad Shops, Yards and Terminals.***

MUCH LONGER SERVICE LIFE AND LOWER MAINTENANCE COSTS insured by heavy, rust-resisting cast metal construction and rain-tight gasket seals.

COMPLETE SAFETY FOR THE OPERATOR is provided by safety circuit grounding and the interlocking of door and plug receptacle with a quick make and break switch mechanism.

PYLE QuelArc plugs, used with this equipment, are well known industrially, for their unique partitioned construction. Long insulating surfaces from pole to pole, and from poles to ground provide for exceptionally safe handling and long service life.

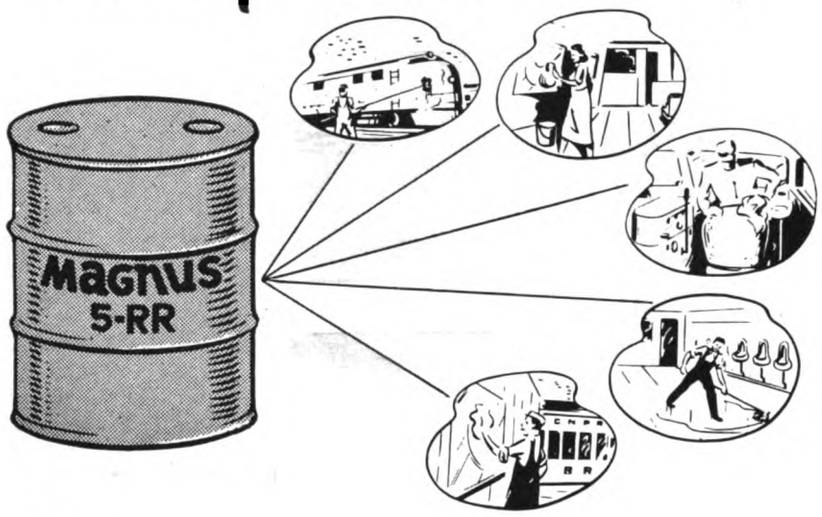
Consult your Pylet Catalog, Bulletin 1150 for complete listings.

SINCE 1897

THE PYLE-NATIONAL COMPANY
1356 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS
District Offices and Representatives in Principal Cities of the United States
Export Department: International Railways Supply Co., 30 Church St., New York.
Canadian Agent: The Holden Co., Ltd., Montreal.

PLUGS AND RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • GYRALITES • CONDUIT FITTINGS • MULTI-VENT AIR DISTRIBUTION

Safe - Fast - Thorough Cleaning - at Lower Cost!



You don't have to stock a lot of special cleaning compounds for the many different cleaning operations where removal of ordinary oily, greasy dirt is involved! Here's *ONE Cleaner* that not only cleans faster and better at lower labor cost than any other cleaner available—special or ordinary—*but* disinfects and deodorizes as it cleans.

Give Magnus 5-RR a Try-Out!

This solvent-soap dissolves, emulsifies and disperses oily, greasy dirt without the use of a lot of "elbow-grease." You just use a little in water solution . . . and it works as well in cold as it does in hot water. Spray—brush—sponge it on . . . then rinse it off.

Magnus 5-RR is harmless to paint or varnish. It is very easy on the hands. And it leaves every surface on which it is used bright and clean without streaking.

Try a Drum of Magnus 5-RR for 30 Days

Use it on any oily, greasy surfaces you have to clean—diesel cabs . . . diesel exteriors . . . coach interiors . . . headliners . . . washrooms . . . toilets . . . linoleum and tile . . . station walls and woodwork . . . station floors and all other painted and varnished surfaces. *Then,* if you are not completely satisfied after 30 days of using Magnus 5-RR according to our recommendations, we will gladly cancel the invoice!

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

MAGNUS CLEANERS AND CLEANING EQUIPMENT

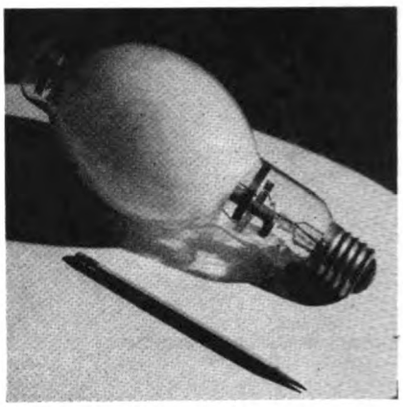
Representatives in all principal cities

NEW DEVICES

(Continued from page 106)

cooled Life-Line motors in N.E.M.A. frames 254 and 284, (5 and 7½ hp., 1,750 r.p.m.). They will be applied to other motors later.

◆



Fluorescent Mercury-Vapor Lamp

A high intensity mercury-vapor lamp with a fluorescent coating on the inside of the bulb, the 400-watt J-Hl fluorescent mercury-vapor lamp is available from the Westinghouse Electric Corporation.

Designed to provide a whiter light from a mercury-vapor source, the lamp has an inside coat of a phosphor that fluoresces red when activated by invisible ultraviolet light generated by the quartz arc. This tends to balance the spectrum to provide a light that is white enough for most industrial purposes.

Equipped with a BT-37 bulb with an isothermal shape that provides an even operating temperature over the entire bulb wall, the new lamp will burn in any position and can be used in existing fixtures for 400-watt mercury lamps.

Lower brightness of the J-Hl makes operation at lower mounting heights practical, which widens the field of use for mercury lamps. Increased fixture efficiency is obtained by removing the diffusing shield frequently used with the A-Hl.

Electrically similar to the 400-watt A-Hl and E-Hl types, the J-Hl will operate from H-l ballasts.

◆

Direct Heat Rotary Dryer-Screener

Of great interest to operating railroads is the question of drying green sand. This is partially due to the high labor cost when drying sand with the old pot-bellied stoves.

For drying sand and other inorganic free flowing granular material, the Mines Equipment Co., Division of Joy Manufacturing Co., Pittsburgh 22, Pa., has intro-

Pittsburgh's Alkali and Acid-Resistant CARHIDE...

Provides better protection and longer life for covered hopper cars!



● One of the hundred covered hopper cars refinished with alkali- and acid-resisting CARHIDE in use for more than a year by the Rock Island Lines.

YOU can now give added years of service to covered hopper, refrigerator and tank cars with Pittsburgh's alkali- and acid-resisting CARHIDE.

● **This new product** of Pittsburgh's leadership in paint research now makes possible an entirely new degree of protection against the effects of cargoes which quickly destroy ordinary finishes.

● **A number** of leading railroad lines have tested this finish on several hundred cars for periods from one to three years with highly satisfactory results. Tests have demonstrated that such ladings as soda ash, sulphur, phosphates, cement, lime, common salt, alkalis, crude oil and alcohol will not affect it. Furthermore, it has shown high resistance to abrasion as well as to repeated scrubbings.

● **This new CARHIDE** dries as quickly as lacquer—you can maintain one-day finishing schedules.

● **If your line** has cars used to carry corrosive cargoes it will pay you to investigate this new alkali- and acid-resistant CARHIDE. Call on us for suggestions and advisory service.

PITTSBURGH PLATE GLASS COMPANY
Industrial Paint Division, Pittsburgh, Pa.

Factories: Milwaukee, Wis.; Newark, N. J.; Springdale, Pa.; Houston, Texas; Los Angeles, Calif.; Portland, Ore. Ditzler Color Division, Detroit, Mich. The Thresher Paint & Varnish Co., Dayton, Ohio. Forbes Finishes Div., Cleveland, Ohio. M. B. Suydam Div., Pittsburgh, Pa.

Pittsburgh Railway Finishes For Every Need

CARHIDE—for wood and metal freight cars of all types.

LAVAX SYNTHETIC ENAMELS—for locomotive and passenger cars.

STATIONHIDE—adds beauty and attractiveness to stations.

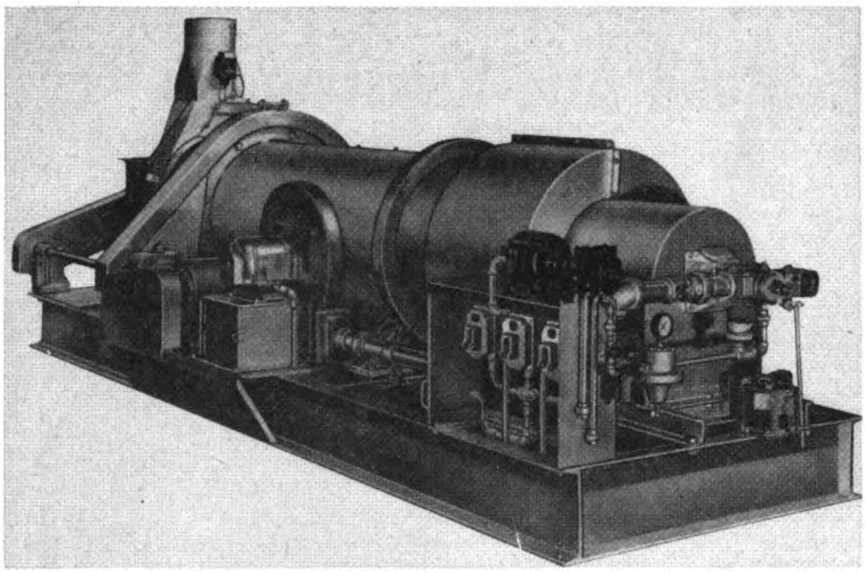
IRONHIDE—for iron and steel fixed properties.

SNOLITE—white fume-proof paint for signs, crossing gates, fences and cattle guards.

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY



duced their direct heat rotary dryer screener. It screens as it dries 2 to 3 tons of sand per hr.

The high evaporating capacity of this unit makes it suited to drying sand needs for traction, sand blasting and meeting the sand-heating or demoisturizing requirements of paving mixtures. It operates on the "counter-flow" direct heat principle, that is the material is fed through dryer towards the source of heat located at discharge end.

Its frame is constructed of structural steel channel; superstructure and drum is made of steel plate. All parts are full welded and securely bolted. The motor is a 2 hp. 220 or 440 volt, 3 phase, 60 cycle unit, fully enclosed and fan cooled. The heating unit is available in a choice of oil or gas burning models.

Hydraulic Remote Control

A new line of hydraulic remote controls have been released by Sperry Products, Inc., Danbury, Conn. These devices are, according to the manufacturer, the only single tube, balanced, self-contained system operating independently without outside sources of power.

The unit consists essentially of a hand-actuated transmitter and a receiver connected by a single tube. The system is filled with hydraulic oil, and due to the oil's incompressibility, force applied to the transmitter is immediately delivered to the receiver.

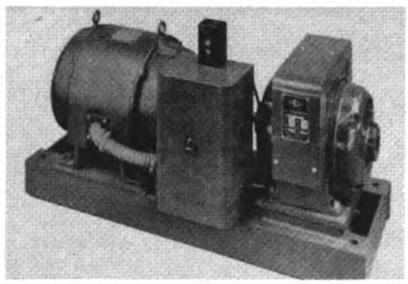
This control system makes possible precision operation of a remote mechanism, free of backlash and the sponginess of the ordinary pneumatic control.

The devices may be used for manual or automatic control of many varied pieces of apparatus in the industrial, automotive, railroad and marine industries. They have a maximum rated output of 400 in.-lb. on the pressure stroke and 125 in.-lb. on the return stroke.

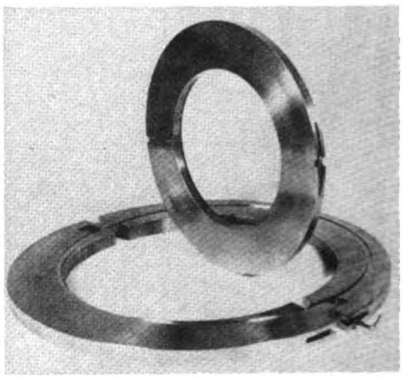
◆

High Cycle Motor Generator Set

For converting 60-cycle current to 180-cycle and 360-cycle frequencies, a new mono-coil high frequency motor generator set has been made available by Electric Machinery Manufacturing Company, Minneapolis, Minn. This machine finds its greatest use in plants using high-cycle automatic electric hand tools such as grinders and buffers. The sets are self-exciting and have built-in voltage regulation which automatically compensates for fluctuations in voltage to the load.



The compact, easily installed unit shown is rated 6 kw., 360 cycles, 3,600 r.p.m. Other ratings and speeds are available.



Split Thrust Washers

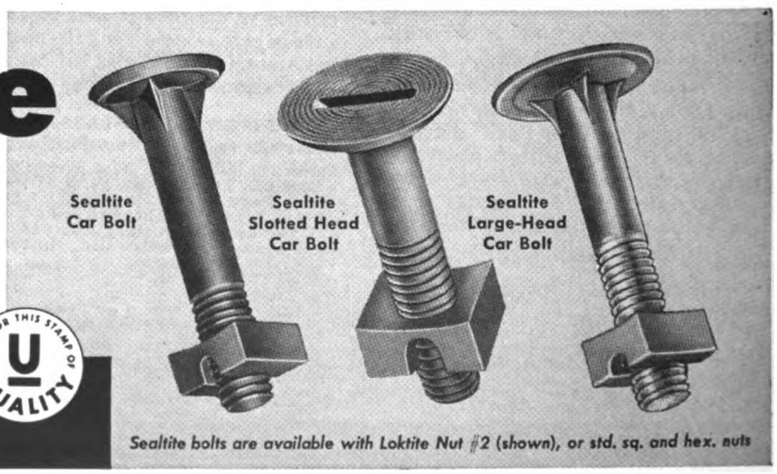
The patented "Sabeco" split washers, manufactured by the Saginaw Bearing Co., Saginaw, Mich., are designed to facilitate repair. It is not necessary to dismantle a machine to install new bearings. The split

Lewis sealtite car bolts

More than 85% of America's Class I railroads use Lewis Sealtite products. Designed to do a better job . . . to last longer . . . to meet the most exacting specifications. Specify Hot Dip Galvanized, Zinc finish for Double-Life and economy.

Lewis BOLT & NUT COMPANY
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LOOK FOR THIS STAMP OF U QUALITY



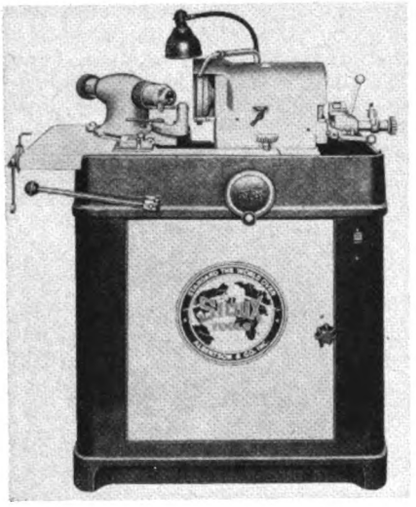
Sealtite bolts are available with Loktite Nut #2 (shown), or std. sq. and hex. nuts

washers are simply slipped over the shaft and locked with the safety key. Thus, the new split washers make possible quick, on-the-spot repair and more economical operation. These washers are suitable for heavy construction machinery; plant machinery; materials moving equipment; oil field equipment; power house and other large electrical installations and large pumping stations or any job using thrust washers.

The replacement split washers are made of a special bronze which is the combination of a high percentage of pure copper, pure tin and pure lead with a maximum of 0.2 per cent impurities.

The manufacturer can supply these split washers in any practicable size, made-to-order to various specification.

◆

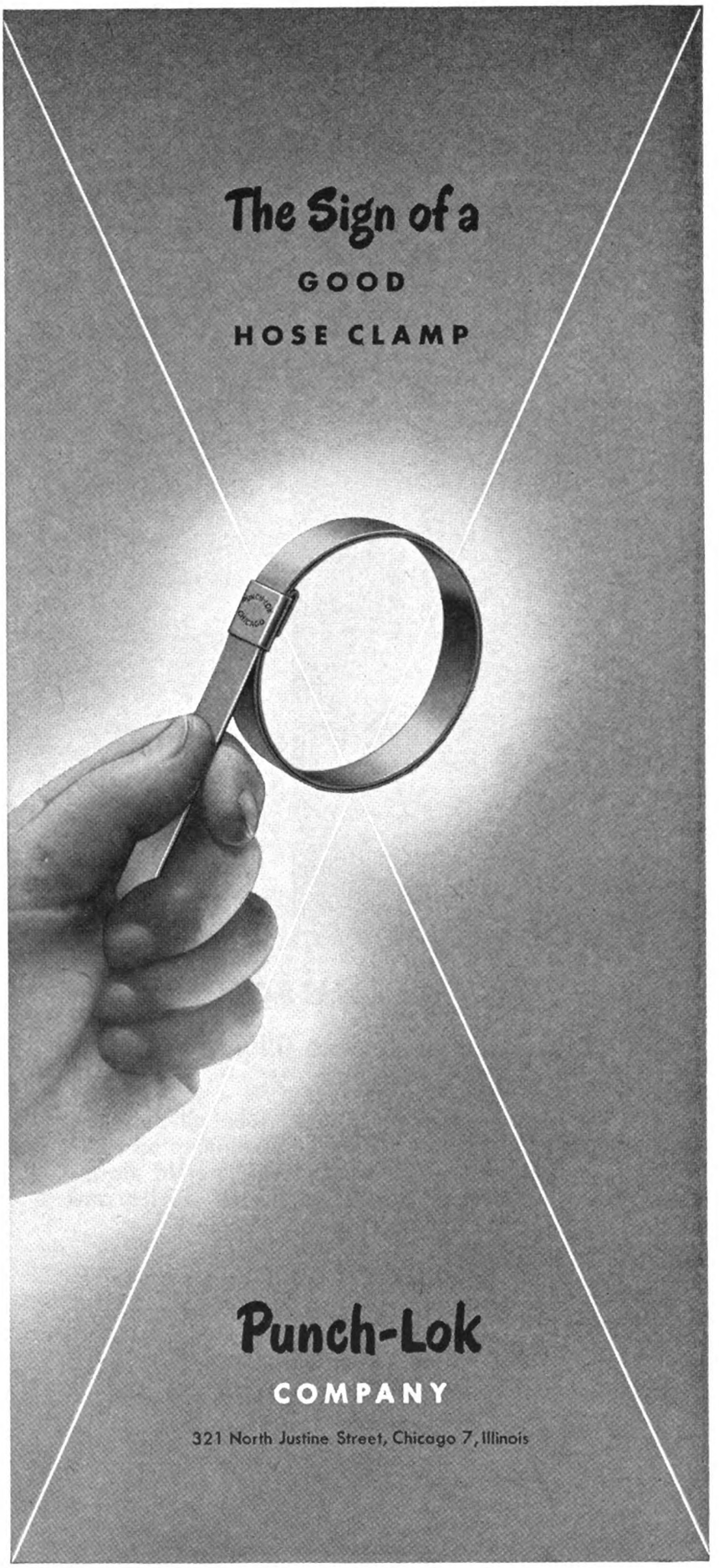


Service Equipment For Diesel Locomotives

A line of machines and special tools for use in reconditioning work on diesel locomotive engines is now being introduced in railroad shops by Albertson & Company, Inc., Sioux City, Iowa. The principal tool is a valve grinding machine which will grind valves up to 6 in. diameter and is arranged for mounting either on a work bench or service cabinet with easy-opening hinge door and ample shelf space for auxiliary tools and equipment such as the heavy-duty valve seat grinding set, grinding wheel dresser, etc., made by this company.

The Sioux valve grinding machine is designed for built-in wet grinding to minimize wheel dressing, heat and distortion and produce an exceptionally fine finish. The machine, illustrated, has a capacity to grind valves with ¼ in. to 1¼ in. stems up to 18 in. long, 6 in. diameter and with angles varying from 15 deg. to 90 deg. It is equipped with a quick acting roller chuck, automatic chuck stop and micrometer graduated feed. The anti-friction chuck slide is mounted on roller bearings. An 8 in. grinding wheel is provided for grinding the valve face and a 7 in. cup wheel for grinding the valve end.

The machine is driven by a 1-hp. 230-volt



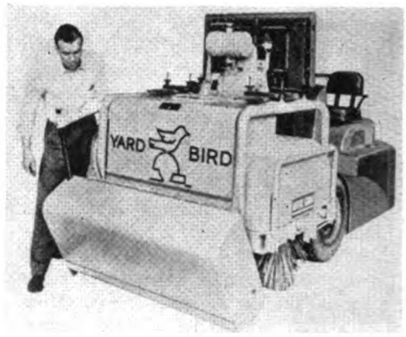
60-cycle single-phase motor. It is equipped with a rigid grinding head having cage-mounted precision ball bearings permanently lubricated. A removable coolant tank permits easy cleaning and has a capacity of 4 gal. A pump mounted in the tank is self-priming. The machine is 32 in. long by 19 in. wide. Standard equipment includes a wheel dressing attachment, micrometer valve end and rocker arm grinding attachments. When desired the machine may be supplied with a lever-operated chuck for more powerful grip, easier and faster operation.

Sweeper Attachment For Fork Lift Trucks

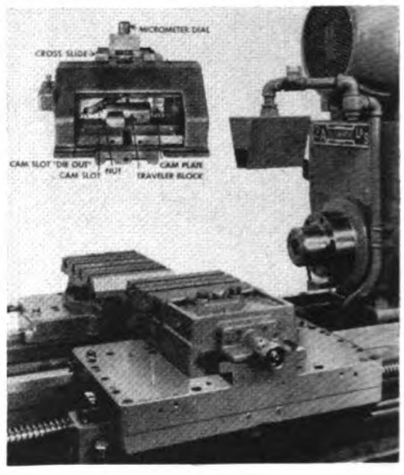
Yard Bird is the name given a new, low-cost powered sweeper, recently introduced by Little Giant Products, Inc., Peoria, Ill., which is designed as an attachment to fit any fork lift truck of 1,500 lb. capacity, and up. The sweeper, operated by the lift truck operator, can clean indoors and out as rapidly as 80,000 square feet per hour with the truck traveling 5 m.p.h.

The Yard Bird has its own self-contained spray system for dust control. A 6.8 hp. gasoline engine turns at 2,400 r.p.m., but an integral clutch reduction unit and sprockets step down brush revolutions to 164 r.p.m. The sweeper is of the pick-up type, with the brush whisking dirt and refuse into a full-width floating dust pan.

The sweeper is designed for quick attachment to the fork lift of the truck during cleanup hours in 2½ to 3 min. Connection is by four eye-bolts and clamping bars on each side just above the pipe frame. Securing is by wing nuts, with no tools required. The 30-gal. water tank for the sprinkler system is built in as an integral part of the Yard Bird hood.



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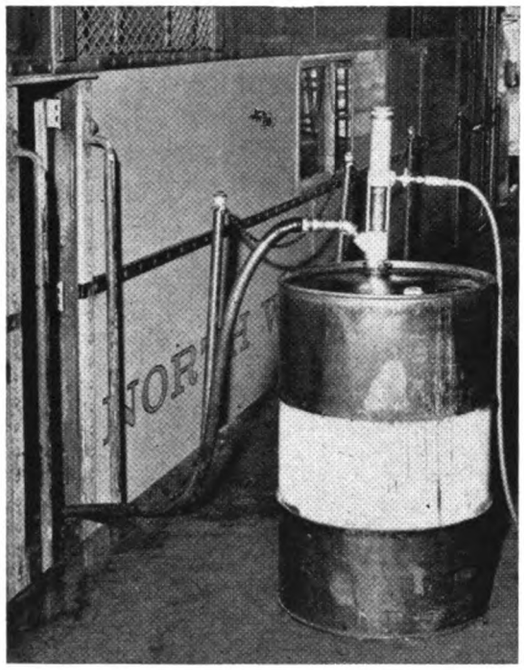


Cam-Operated Cross Slide

A new cam-operated rear cross slide on the Duomatic lathe offers greatly increased rigidity for forming, grooving, necking and similar operations, according to the manufacturer, The Lodge & Shipley Company, Cincinnati, Ohio.

Production increases are claimed for the new arrangement which replaces the former rack and pinion slide. Designed particularly for the operations noted and not for turning, the new slide is heavier and effectively handles even the most difficult forming cuts. When turning with the rear slide is desired, a rack and pinion cross slide can be furnished at additional cost.

The cam, which feeds the slide into the workpiece, has been so constructed to positively move the slide inward at a constant rate. When the tools reach the end of the stroke, the inward feed "dies out" in the cam slot. Thus, the cam itself determines diametral accuracy with absolute uniformity.



WILKINSON

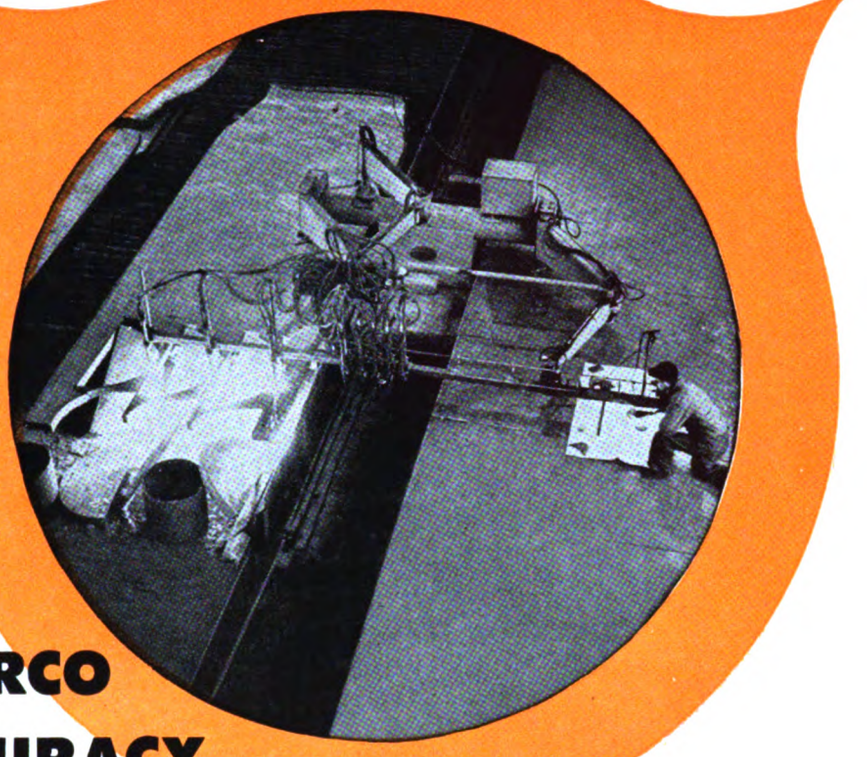
High Speed Diesel Lube Oil Transfer Pump

REDUCE your Diesel lube oil handling time by more than 41% and eliminate oil spillage. Use the WILKINSON light-weight air-operated transfer pump. Only weighs 15 lbs. and no air enters barrel.

You can pump a 55-gal. barrel S.A.E. #40 lube oil in 5 minutes with only one man.

Can furnish ready-to-use,—package consisting of WILKINSON Transfer Pump, 35 feet of ¾" oil hose, and automatic shut-off valve.

HUDSON 3 5271
WILKINSON EQUIPMENT & SUPPLY CORP.
6958 SOUTH WENTWORTH AVENUE
CHICAGO 21 ILLINOIS



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PRECISION ... OPERATING ECONOMY

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AIRCO NO. 50 TRAVOGRAPH

GAS CUTTING MACHINE

Airco's NEW No. 50 Travograph is a rugged, all-welded gas cutting machine. Its massive, long-lived design is engineered to give fingertip sensitivity to all production operations. Used as a basic tool for multi-torch shape cutting, squaring or beveling, its outstanding accuracy slashes reject loss and working costs to a minimum.

Today's most modern production tool, the rugged new Airco No. 50 Travograph precision-cuts steel—light plates, heavy slabs, billets, forgings—to close tolerances. Here are the reasons for its remarkable exactness . . . the "why" it guarantees faithful reproduction.

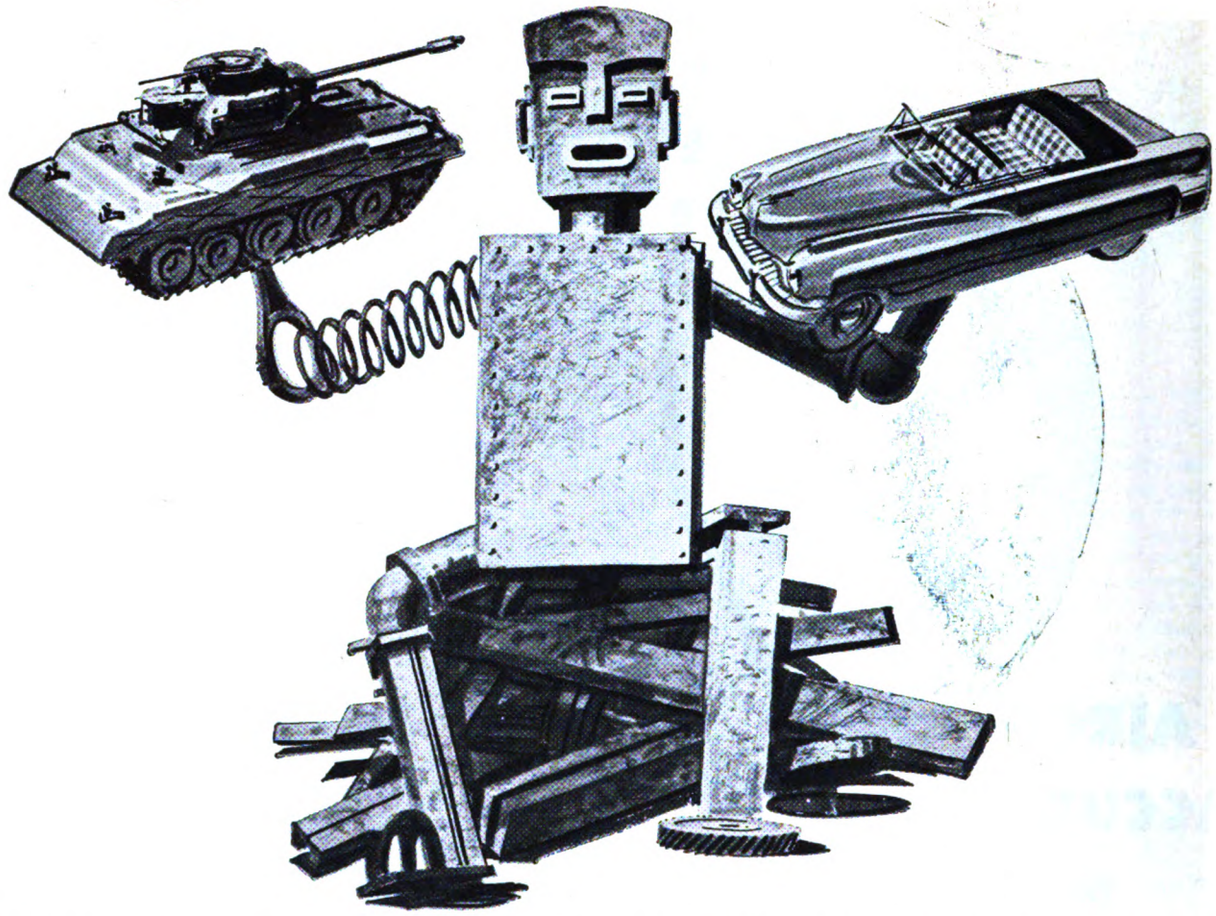
1. All-welded construction provides a combination of ruggedness, resistance to vibration, and precision operation.
2. Rigidity built into the torch-bearing pantograph arms enables the torch bar to support a uniform load of *500 lbs!*
3. Perfectly-balanced when properly set on 16′ rails.
4. Ball bearings in the hinge joints make it extremely smooth operating.

For greatest operating flexibility, the new No. 50 Travograph can be equipped with three distinctly different tracing devices—manual, magnetic, or the full-automatic "Electronic Bloodhound". The "Electronic Bloodhound" needs only an outline drawing or silhouette to cut the most intricate shapes smoothly, sharply, quickly . . . and with extreme accuracy.

If your production line requires quantity flame shaping operations . . . and if close precision cutting would lower your finish-machining costs . . . it will pay you to investigate Airco's new No. 50 Travograph. For complete information write your nearest Airco office for the new catalog just coming off the press.

AIRCO **AIR REDUCTION**

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REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL
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How Can America Produce All the Steel It Needs . . . for Military . . . and Civilian Purposes?



FREE BOOKLET Tells How to Conduct Scrap Salvage Program in *Your* Business.

Address Advertising Council, 25 W. 45th St., New York 19, N. Y.

One way is to feed more pig iron into the furnaces. But . . .

That will require *more* supplies of ore, limestone, coal, etc.*—to say nothing of more new ore boats and rail cars to transport the additional supplies.

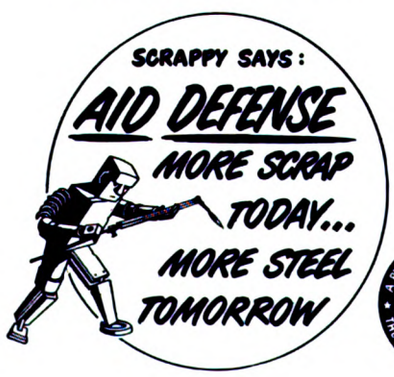
A better way—the *only* practical way—is to use the *dormant* iron and steel scrap lying around in the form of old machines, equipment, tools and metal structures.

Your business *must* have available scrap—in *some* form. That scrap is *needed* to keep the furnaces going in the steel mills . . . to keep our fighting forces and our allies well armed . . . to sustain our civilian life at home.

Think how many ways *you* use iron and steel. Think what would happen if it became extremely scarce. Put your iron and steel scrap to good use—now—by selling it to your local scrap dealer.

Don't delay—the emergency is becoming more severe every day.

*For every ton of scrap fed into the furnaces, we save approximately 2 tons of iron ore, 1 ton of coal, nearly ½ ton of limestone and many other critical materials. Also, scrap helps make steel faster, shortens the refining process.





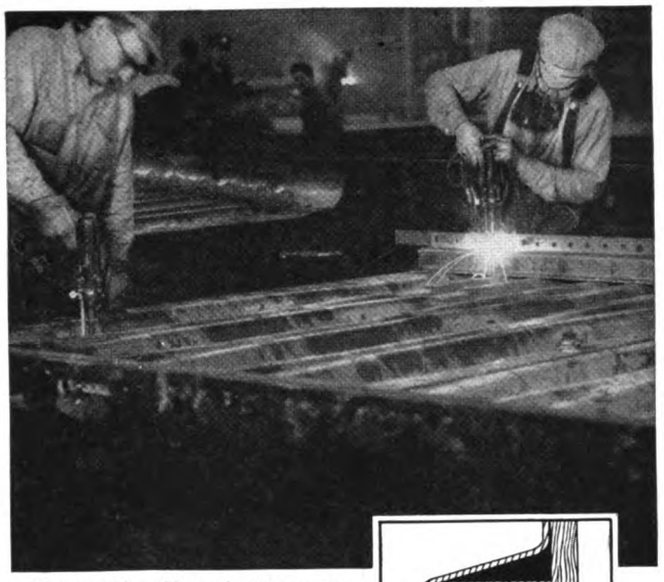
NON-FERROUS SCRAP IS NEEDED, TOO!

This advertisement is a contribution, in the national interest, by

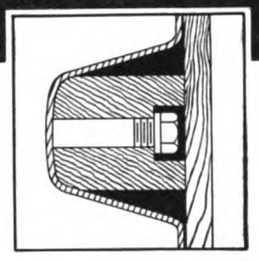
RAILWAY MECHANICAL AND ELECTRICAL ENGINEER

SOLVED BY NELWELD

Cost-Saving TECHNIQUE FOR CAR BUILDERS



Split-second welding of studs to car ends with the Nelweld method. Portability of the lightweight Nelweld gun permits using it in any job location or working position.



Neater, permanently WATERTIGHT car ends result from Nelwelding studs to secure furring strips. Studs may be located by center punch marks or simple templates.

. . . CUT COSTS WITH NELWELD

Cost-saving techniques in car building are provided by the Nelweld method. Workmen using portable Nelweld guns, weld studs in position in a fraction of the time required for other methods.

Nelweld speeds up production and lowers costs by (1) eliminating drilling or punching, tapping, or hand welding; and (2) reducing manpower and materials handling time on heavy car sections during fabrication. Take the tool to the job and weld each Nelson granular flux-filled stud in a fraction of a second.

Smoother exterior surfaces, stronger members, and lower maintenance costs result from the elimination of punched or drilled holes when the Nelweld method is used.

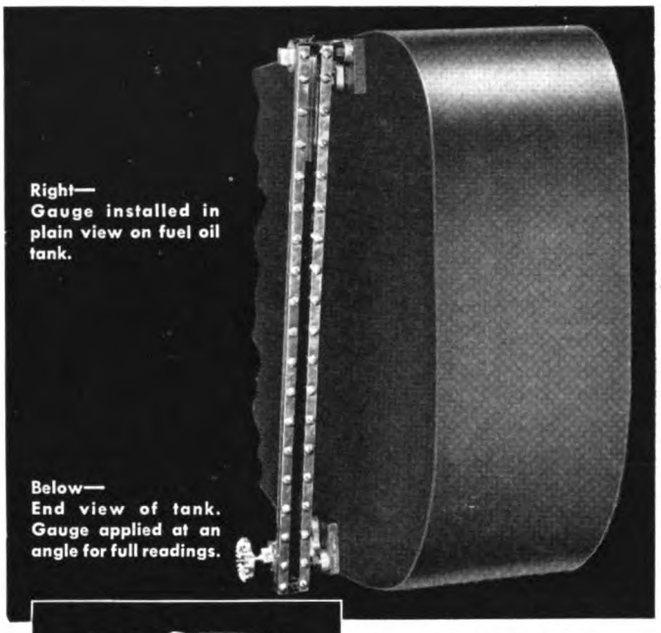
Full information and Nelweld Engineering Service are available to show you how these advantages can bring cost-saving results to your fastening operations. Contact your nearest Nelson representative or Dept. R-1, Lorain, Ohio.

Fasten it Better...at Less Cost, with NELWELD

NELSON STUD WELDING

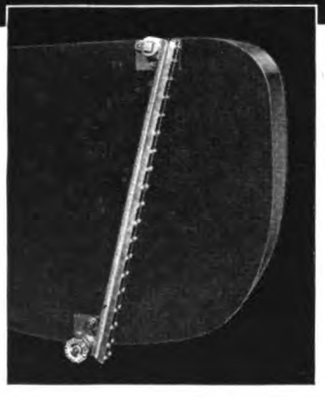
DIVISION OF GREGORY INDUSTRIES, INC., LORAIN, OHIO

Get Full Readings on Diesel Fuel Tanks with this New MAGNUS GAUGE



Right—
Gauge installed in plain view on fuel oil tank.

Below—
End view of tank. Gauge applied at an angle for full readings.



A top-to-bottom gauge, flexible — mountable at any angle, the new Magnus diesel fuel tank gauge gives accurate full readings at all times. With a rigid brass body, the Magnus gauge is substantially built to stay on the job longer . . . not to be disturbed by vibration.

It's easily installed—simply by welding top and bottom plates to tank and drilling two holes. The reflex glass gives you accurate readings at a glance. For quick clean-out, just unscrew top and bottom plugs. Automatic shut-off valve prevents fuel loss in case of breakage.

Write for further information.

MAGNUS BRASS MFG. CO.

Subsidiary of National Lead Co.

525 Reading Road **Cincinnati 2, Ohio**

The Proof of a Product is its Endorsement



Experience has proved that Ex-Cell-O hardened and ground steel pins and bushings last longer. That's why so many American railroads have standardized on Ex-Cell-O products. They have found that by resisting road shock and vibration, Ex-Cell-O pins and bushings reduce wear on costly foundation parts; cut out-of-service time to a minimum; frequently give from four to six times longer service than other pins and bushings. Standard styles and sizes for steam, Diesel and passenger car equipment are listed in Ex-Cell-O Bulletin 32381. A free copy is yours on request.

XLO
EX-CELL-O for PRECISION

HARDENED AND PRECISION GROUND
STEEL PINS AND BUSHINGS

51-16

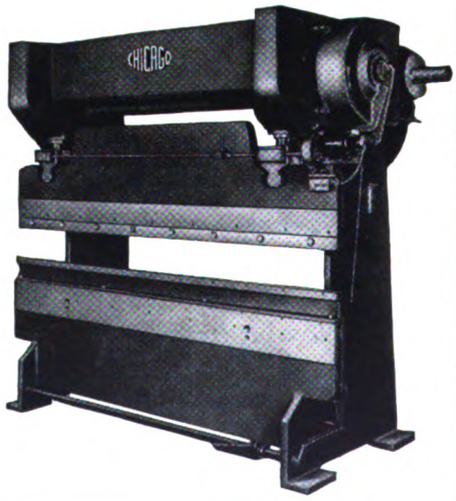
Railroad Division **EX-CELL-O CORPORATION** Detroit 32, Michigan

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STEEL
CHICAGO **PRESS BRAKES**

Readily adapted for a wide variety of bending, forming, drawing, notching, blanking, punching, etc.

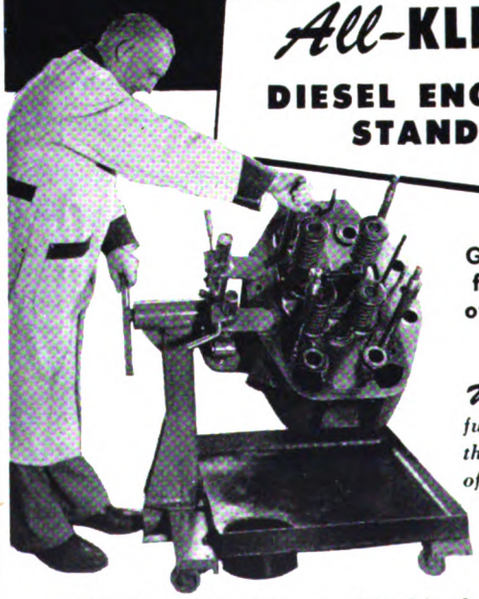
Complete Line of DIES for All Makes and Sizes of PRESS BRAKES



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SAVE LABOR! STOP ACCIDENTS!

All-KLEER
DIESEL ENGINE STAND



Gives you easy, faster servicing of Diesel Engine Heads.

Write for folder fully describing this essential piece of shop equipment.

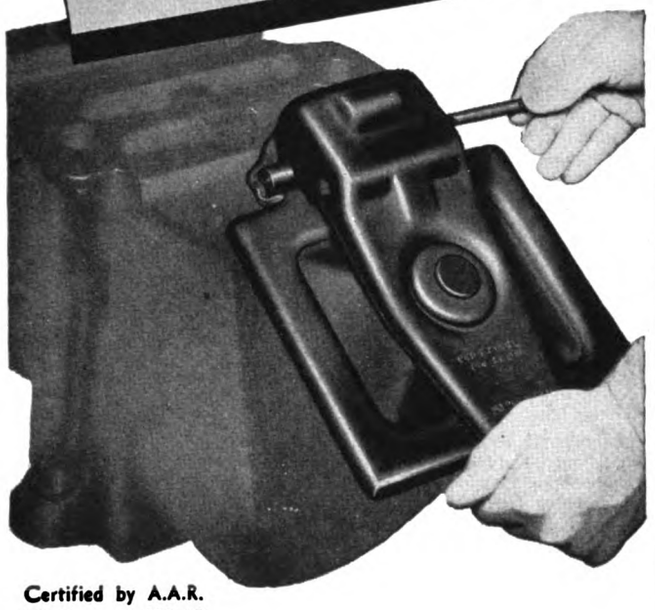
● All-Kleer holds almost any Diesel head regardless of size or make. Engaging pins are changed to fit different size head bolt holes. Simple hand adjustment sets head-grasping mechanism for any head. Geared, non-slip, positive action engaging pins rotate freely to fit any dowel pattern. Speeds service work to a degree not possible by any similar device. Every shop needs this stand.

R & G MANUFACTURING CO.
OFFICES 504 WYSOR BLDG. MUNCIE, INDIANA, U.S.A.

for complete simplicity and peak durability

MOTOR WHEEL

JOURNAL BOX LIDS



Certified by A.A.R.
To Spec. M-120-47

- ATTACHED OR REMOVED WITHOUT TOOLS
- FULLY ARTICULATED
- WEAR REDUCED BY ¾" PIN BEARING AND ROLLER ON TORSION SPRING

DEEP FLANGE MODELS

Provide added protection from wind currents carrying foreign matter and moisture so harmful to efficient lubrication.



MOTOR WHEEL CORP.
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National Railway Sales Representative
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HEAVY DUTY PNEUMATIC TOOL #69015

Either "STUB" or conventional side position crimping with AMP's double-handled Pneumatic Tool. Interchangeable jaws for wire sizes #6 to #1/0.

SOLISTRAND® BUTT CONNECTORS

Can be used on solid, stranded or irregular shaped wire. These pure copper connectors make strong, vibration-proof permanent splices #22 to #4/0.



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AIRCRAFT-MARINE PRODUCTS, INC.
2100 Paxton Street, Harrisburg 13, Pa.

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If you want to know what position Bill Smith is now holding down on the XYZ RR you can obtain this information by looking him up in the new Twelfth Edition of WHO'S WHO IN RAILROADING. As a railroad officer Bill has written himself up.

There are 6,100 other names beside your old friend Bill Smith in the new edition, which will be ready by October 31st. Send for your copy today—on the usual Ten Days' approval—and brush up your knowledge of men you ought to know more about in the railroad industry.

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B. K. SWEENEY MFG. CO., DENVER 17, COLO.

A Practical Evaluation of

Railroad Motive Power

By P. W. KIEFER

Chief Engineer, Motive Power and Rolling Stock, New York Central System

The first authoritative information in book form of the comparative advantages of standard types of railroad motive power—steam, Diesel-electric, and electric. Based upon the results of a study made by the New York Central System of comparative operating costs of all three types on main line divisions.

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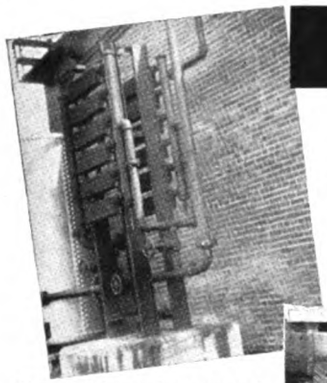
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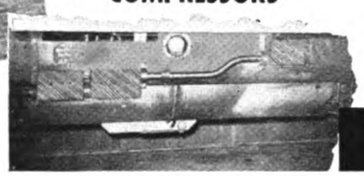


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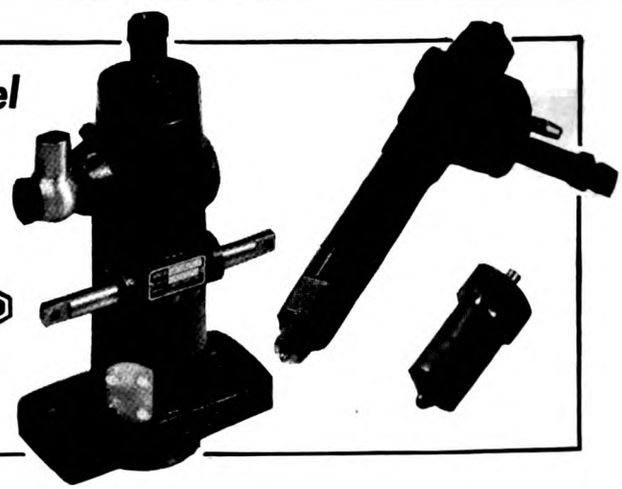
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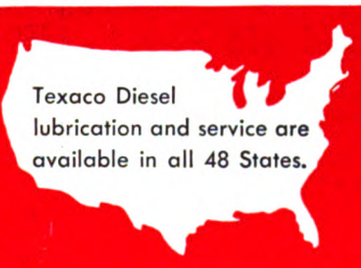
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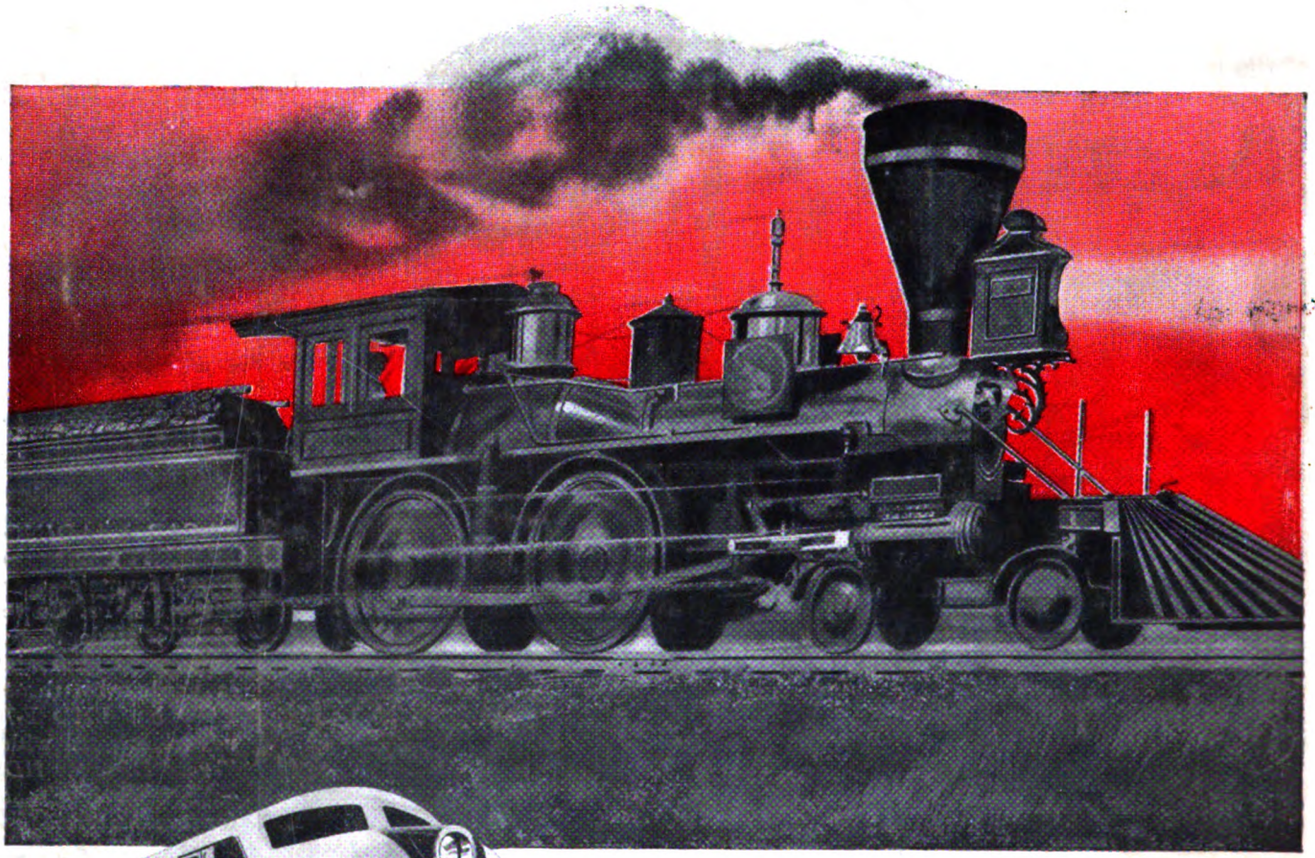
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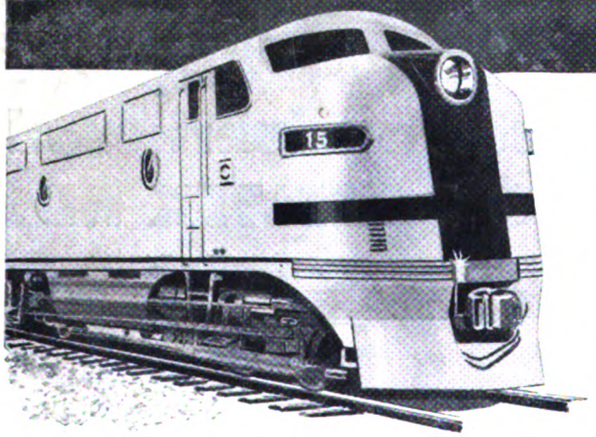
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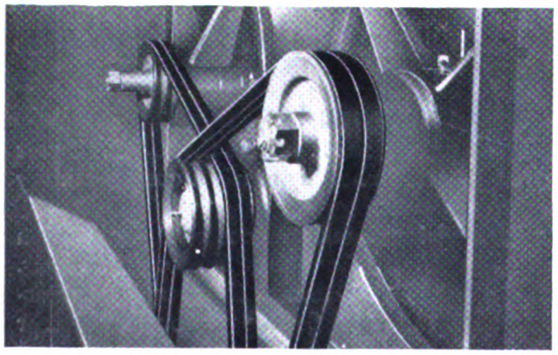
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